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PROGRESSIVE MEDICINE

A QUARTERLY DIGEST OF ADVANCES, DISCOVERIES
AND IMPROVEMENTS

IN THE

MEDICAL AND SURGICAL SCIENCES

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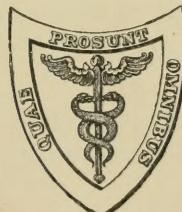
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VOLUME IV. DECEMBER, 1921

DISEASES OF THE DIGESTIVE TRACT AND ALLIED ORGANS, THE LIVER, PANCREAS
AND PERITONEUM—DISEASES OF THE KIDNEYS—GENITO-URINARY DISEASES
—SURGERY OF THE EXTREMITIES, SHOCK, ANESTHESIA, INFECTIONS,
FRACTURES, DISLOCATIONS AND TUMORS—PRACTICAL
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PROGRESSIVE MEDICINE.

DECEMBER, 1921.

DISEASES OF THE DIGESTIVE TRACT AND ALLIED ORGANS, THE LIVER, PANCREAS AND PERITONEUM.

BY MARTIN E. REHFUSS, M.D.

In the review of gastro-intestinal diseases we have followed the same general method of approach as in former communications. It is not possible to cover accurately the entire field of gastro-enterology inasmuch as there is a noticeable return to activity and interest in this field all over the world. In fact, it can be said that with few exceptions the notable contributions on gastro-intestinal conditions are those which have been given by individuals who have confined all their interest to this line. There is a noticeable change in the direction of methods of analysis; the digestive tract has participated in the general trend of modern medicine toward functional diagnosis. We have now at our disposal means of investigating the functional capacity of practically every section of the digestive tract. The student of gastro-intestinal diseases cannot remain oblivious to the advances which have been made in other departments of medicine, particularly those departments which have a more or less direct bearing on this tract.

There have been many communications on the effect of various food-stuffs, both chemical and physiological, and the interest in vitamines which is manifested throughout the world cannot fail to leave its impress on this subject. In fact, the future points to definite advances along the line of a more complete understanding of the action of the autonomic nervous system and its association with the endocrine glands. Many of us are alive to the possibilities of this line of work, but there seems to be no well-defined, practical way in which we can estimate their significance. More and more attention is being paid to this field, and it is to be hoped that the time will not be far distant when we can measure directly the effect and extent of the autonomic nervous factors in digestive diseases. A new interest has been manifest in the study of the psychic disturbances of digestion, both in this country and abroad. Furthermore, it is becoming increasingly noticeable that precise methods of examination, precise insofar as they are practicable clinically, are

taking the place of the time-honored methods which have been used hitherto. The chemist is supplying us not only with data regarding the composition and value of the dietary but also the digestion of the various foodstuffs, both normally and pathologically, in the digestive tract. This contribution must be assimilated in our general knowledge of gastro-enterology, although no place has been reserved in this review for their introduction. It is to be noticed in glancing over the literature, that more or less exact routine methods are employed in the leading clinics for the study of digestive cases. In other words an examination of the stomach, duodenum, fecal movements, as well as an exact study of the digestive tract by means of the *x-ray*, are routine procedures which should reveal the presence of the great majority of conditions which effect this portion of our anatomy.

On the other hand, there is room for the bacteriologist, and throughout the literature it is evident that an awakening regarding the possibilities of focal infections in other parts of the body, particularly in the upper respiratory tract, has a very marked bearing upon conditions lower down in the digestive tract. It is interesting to note that there is a tendency to recur to the importance of fecal analysis as a measure of digestive work, but we can recall contributions far more illuminating and far more complete, such as the work of Goiffon and Matheu, in Paris, and Schmidt, in Germany, than those which have recently occurred in some of the medical journals. It is rather remarkable to note that these common-place articles regarding time-honored truths have received rather flattering comments in some of our medical periodicals. This state of affairs is only consistant with ignorance of these subjects. It is also interesting to note, particularly in the French literature and almost not at all in our own, the renewed interest which is attached to the study of the diseases of the colon. They seem to realize the frequency with which disturbances in that region can assimilate appendicitis, and not only have they gone thoroughly into this subject, but they have emphasized what must impress every critical observer, *viz.*, the frequency of this colon condition. Duodenal intubation has received an impetus in the work of Lyon. There is no question that exact methods of duodenal intubation were few and far between before these possibilities were recognized. We feel that while the status of fractional separation of the bile is still uncertain and it is advisable to withhold a definite opinion on this subject, nevertheless anything which will contribute to bringing out the value of this method of investigation is certainly of great value. The fundamental principles regarding the character of the material and its characteristics in disease has long been known, but the practical emphasis on this method of examination is one which we believe is still under discussion.

Another point of interest is the extraordinary feature of safety seen in the various organs. This is not only true regarding the stomach and bowel, but also the liver. In fact, we look forward to advances all along the line, particularly along the lines of more exact diagnosis as well as a more complete conception of many of the conditions which as yet are obscure. It is to be hoped that the immediate future will settle

many of the problems related to intestinal stasis. In fact, it is interesting to note that less and less attention is being paid to the position of organs, and more and more attention to function. It seems to me that there is a greater tendency among intelligent clinicians toward disregarding any but advanced alterations in the position of organs. This statement naturally refers to the question of ptosis, regarding gastrophtosis and coloptosis. One feels that it makes a great deal more difference as to whether the stomach and intestine empty normally than as to the question of their position.

DISEASES OF THE ESOPHAGUS.

Diverticulum of the Esophagus. Hartman,¹ in this communication, mentions the fact that a diverticulum of the esophagus may be mistaken even by x-ray examination for spasm or stenosis. This was the case in two instances in his observation. In one case, a man aged sixty-five years, the opaque meal merely indicated spasm, but Hartman suspected a diverticulum owing to the fact that he noticed that there was a peculiar sensation in this region when the larynx was pushed back. This sensation entirely disappeared when the diverticulum was emptied by pressure.

Another was the case of a woman aged sixty-one years who showed esophageal retention. This woman noticed that the pocket emptied itself when she laid on her side. The main point in this communication is the fact that diverticulum can occur even when symptoms point to a mere stenosis. Consideration is also given to the surgery of diverticulum.

Krossnigg² reports a fatal case of the formation of a tracheo-esophageal fistula in the syphilitic individual. While the vast majority of these cases are usually carcinomatous in origin, and only a small number are tuberculous and congenital, in this particular case the cause of death was a bilateral pneumonia with early gangrene of the right lung. It is a known fact in these cases that specific treatment may actually increase the size of the perforation. These cases are usually not recognized until the damage is done.

Axhausen³ reports a series of cases, 4 in number, in which, owing to an impassable stenosis of the esophagus from caustics, he tunneled out a new esophagus under the skin. In several of the cases this new esophagus served the purpose perfectly. The article describes in detail the technic which has been used.

Dilatation of the Esophagus Without Stenosis. The *Lancet*, June 11, 1921, p. 1255, devotes an editorial to this subject. It is interesting to note that enormous dilatation of the esophagus may take place with almost total inability to swallow, and yet there is no obstruction whatsoever. Reference is made to the discussion which occurred on this subject several years ago at the laryngological section of the Royal Society of

¹ Jour. de Chir., Paris, 1920, No. 5, **16**, 481.

² Wien. klin. Wochenschr., February 5, 1920, No. 6, **33**, 120.

³ Beitr. z. klin. chir. Tubingen, 1920, No. 1, **129**, 163.

Medicine as well as the recent contribution by Bensaude and Guenaux, of Paris, none of which clear up the etiology of the condition.

Certain points seem to be clear; *viz.*, that food is arrested at the level of the deformity and not at the cardiac orifice. Second, that there is no hypertrophy of the cardiac sphincter, and, third, that the muscular wall of the gullet is not atrophied but rather hypertrophied. Mention is made of the fact that by modern methods this condition is readily diagnosed. One of the authors, for instance, who had only seen 1 case in fifteen years has now diagnosed 17 cases in eighteen months. Of these 17, 12 were females, and the neurotic element was apparent. While 2 cases were found in childhood, the majority were between thirty-three and fifty-five. The symptoms are fairly consistent with a slow, insidious onset, a sensation of the arrest of food at the lower part of the gullet, eructations, inability to take certain foods, regurgitation, vomiting, cough, and periods of complete occlusion. The vomiting is without nausea or effort, and, as the editorial suggests, resembles the overflow of a very full vessel. *X-ray* is characteristic and shows a cylindrical shadow ending in a regular, finely pointed extremity. Examination with the esophagoscope shows the dilatation of the entire wall of the esophagus which is arranged from top to bottom in transverse folds.

This editorial is a timely one and the condition is by no means unknown on this side of the water. In fact, spasm of the cardia or a condition exactly similar to the one described has been discussed in many instances in American literature. One physician known to the reviewer has a large series of these cases under treatment, and while the name "idiopathic dilatation of the esophagus" can be used, it has been commonly supposed that the lesion was one of cardial spasm. Sometime ago, Guisez, of Paris, described the frequency with which a fissure occurred in that region as a possible cause of this condition. However, recent communications, such as the present one, failed to reveal the presence of such a lesion which might readily be overlooked. One point, however, is of value and that is the fact that slow dilatation certainly brings relief. We have seen 2 of these cases in the last year in which no possible cause could be assigned for the trouble, both of which were completely relieved by dilatation.

Esophageal Stricture Treated by Continuous Dilatation. Mossajo⁴ records the case of a man, aged twenty-four, who developed a stricture of the esophagus after the swallowing of caustic potash. Senn's gastrostomy was performed and he was fed through a catheter for a month and then made to swallow a bullet, to which a silk thread had been attached. The bullet was then located in the stomach by means of an esophagoscope and then a fine rubber sound was attached to the end of the string protruding from the mouth. By pulling on the other end of the string this sound was introduced within the strictured area, where it was allowed to remain for thirty minutes on the first day, and for increasing periods of time on succeeding days. In two months it was possible to introduce a sound of normal caliber which was left in place for twelve

⁴ Arch. de Med., Cirug. y Especialidad, March 1, 1921; Abstracted, British Medical Journal, June 4, 1921, p. 91.

hours, and in three months, normal conditions were established. This through and through treatment is worthy of mention as an ingenious method of dilatation in a comparatively severe obstruction.

DISEASES OF THE STOMACH.

The Action of Saliva on Starch in the Presence of the Gastric and Pancreatic Secretions. Pastore's⁵ series of experiments were carried out to show the effect of saliva in the presence of the gastric and pancreatic juices of dogs and also the gastric and pancreatic extracts of men. The first series of cases shows the pronounced action of human saliva on starch in mild alkaline concentration, even to a dilution of one in eight thousand; but above this dilution digestion cannot proceed without neutralization. A concentration of one in two thousand always destroys the amylolytic power when ptyalin is present with hydrochloric acid alone.

In a second series of cases, it was demonstrated that the mixed human saliva retains its starch-splitting power both in the presence of the gastric and the pancreatic secretions of dogs as well as the similar secretions of man. It was further demonstrated that the peptic power of the gastric juice of the dog, as well as the human gastric secretion, is conserved in the presence of saliva. In other words, it was demonstrated that the saliva was able to retain its power even in the presence of moderate gastric acidity, and, furthermore, it may retain its activity in the duodenum and in the small intestine, in no way modifying the activity of the peptic ferment or three enzymes of the pancreatic secretion.

In a Study on the Effect of Age on Pancreatic Enzymes, Fenger and Hull⁶ stored up samples of the desiccated fat-free powder preparations of the hog's pancreas in well-stoppered, partly-filled, amber bottles and kept them for a year at room temperature. At the expiration of that time, there was noted considerable reduction in both diastatic and lipolytic activity, but the proteolytic activity remained practically unimpaired. It is therefore evident that the tryptic enzyme is the most stable of the pancreatic enzymes.

Action of the Pylorus. McClure, Reynolds and Schwartz⁷ studied the pyloric sphincter after the administration of various foodstuffs. They found that finely divided foods, whether protein, fats or carbohydrates, begin to leave the stomach within a very few minutes after they are ingested. Under normal conditions, the antrum wave allows a little of the material to go through with each contraction only to close the pylorus after this contraction has spent its force. It was interesting to note in this series of reports that the introduction of $\frac{1}{10}$, $\frac{1}{20}$ or $\frac{1}{40}$ normal solution of the hydrochloric acid into the first, second or third part of the duodenum failed to produce any noteworthy influence on the opening of the pyloric sphincter, and, what is more to the point, neutra-

⁵ Archiv. d. farmacol. speriment. e sc. affini. 30, 183, 177, Milan, December 1, 15, 1920.

⁶ Journal of Biological Chemistry, May, 1921, **46**, 431.

⁷ Archives of Internal Medicine, October, 1920, No. 4, **26**, 410.

lization of the contents of the first part of the duodenum did not prevent the closing of the sphincter. These studies were made by mixing food material with barium. They represent a series of fluoroscopic studies which lead these authors to believe that the acid factor was not the principle one in control of the pylorus. We believe that this contribution is one of several which casts very serious doubt on the importance of the acid mechanism of the pylorus. There are many facts which have been obtained on both pathologic and normal individuals which indicate the probability of some other factor beside the acid one as the truly responsible agency for the action of the pyloric mechanism.

Physiological and Pharmacological Studies of the Artificially Surviving Human Stomach. One-third of the stomachs of patients were examined after they had been removed for ulcer of the duodenum and put in cold Ringer's solution for warm-blooded animals. Just before the experiment, which Tesner and Turol⁸ carried out from four to five hours after the operation, the mucous membrane was separated from the musculature. The technic of the experiments was that used by Magnus. The piece of stomach was cut into longitudinal and diagonal strips and the strip for the test was fastened at one end with thread to a glass tube bent hook-shaped with an opening at its lower end for the passage of oxygen. The other end of the strip was bound to the graphic apparatus with a serrefine and a thread. The strip hung in a glass vessel of 100 cc capacity, and the temperature of the Ringer's solution, through which a current of oxygen was run, was kept constantly between 36° and 38° C. The tests showed that the human stomach shows regular automatic movements in the fundus as well as in the pyloric part for many hours after its removal from the body. This rhythmical activity of the surviving stomach was marked by a great regularity which was influenced in different ways by toxins. The results obtained with the surviving pyloric strips generally correspond with the results of the roentgenological methods applied to the living stomach. It was noted that morphine increases the frequency of the rhythmical movements about double, that acetylcholin increases the stimulation as well as the frequency of the single contraction waves, while barytes considerably increases the frequency of the rhythm as well as the muscular tone. Barytes also proved a powerful stimulant of the Auerbach's plexus ganglia. Atropine alters very slightly the spontaneous movements of the stomach, but it inhibits the periodical contractions of muscle strips that have been subjected to acetylcholin action. Adrenalin acts as an inhibitor to the rhythmical movements of the pylorus strips except those stimulated vagally by acetylcholin. Papaverin paralyzes any automatic activity.

Distribution of the Acid Cells of the Stomach. Radasch⁹ has made a careful histological study of various portions of the gastric mucous membrane from several subjects, one of whom was electrocuted and the others from ordinary postmortem specimens.

The questions which he sought to answer were, first, how far do the

⁸ Ztschr. f. d. ges. exper. Med., 12:75. Berlin, March 30, 1921.

⁹ International Journal of Gastro-enterology, July, 1921, No. 1, 1

oxyntic or acid cells extend toward the pyloric orifice; second, is the distance fairly divided within moderate limits; and third, is the distance the same in percentage along the lesser, greater and ventral curvatures.

In this study, sections were made of the mucous membrane and also studies of rabbits were made, and while some of the stomachs were rather disappointing as to the number of acid cells, they all agreed in the suddenness with which these cells cease. Where possible, a continuous section in series was made from the cardiac to the pyloric orifice. From his tables it is evident that the acid cells do not extend as far along the lesser curvature as they do along the other curvatures. In the human stomach, they run on an average of 63.97 per cent or approximately $\frac{2}{3}$ of the distance. In the rabbit's stomach they run approximately $\frac{3}{4}$ of the distance. Along the greater curvature the average was 78.2 per cent, or almost $\frac{3}{4}$ of the distance to the pylorus, and in the rabbit's 74.3 per cent. Along the ventral curvature the average was 76.1 per cent. From these studies it is apparent that the acid cells extend to a considerably greater distance along the greater and ventral curvatures than the lesser, and that these limits are fairly constant. Furthermore, it was apparent that the acid cells usually show an abrupt decrease at the marginal zone.

The author says this transition is so sudden as to be characteristic and is accompanied by a change in the character of the gland, the branched tubular gland suddenly making its appearance and the simple tubular gland ceasing. The change, in fact, is so striking as to be noticeable to the unaided eye. The author says that it is readily evident that when the true branched glands begin, the acid cells must cease, and, should there be a lack of acid cells along the normal distribution area, there is no replacement of these cells in the pyloric area, so that these two divisions are as essentially separate as though they were separate organs. The author brings up the question as to whether there is any relationship between the distribution of the acid cells and the clinical and anatomical divisions of the stomach. The author questions very greatly as to whether the *incisura angularis* actually marks the histologic junction. He is of the opinion that it has nothing to do with the histology of the mucous membrane.

Another point of interest is the question as to whether the mucosa increases in thickness from the cardia end of the pylorus. From the studies of Radasch, there is no regularity in the thickness. This contribution is of unusual interest because it is in the last third of the stomach, and particularly the last half of the lesser curvature, that ulcer is so commonly found. While ulcer is by no means limited to the tubular gland-bearing area, its far greater frequency in this region would lead us to believe that there is some association. It would be a matter of considerable interest to find out the relative resistance of these two portions of the stomach to infection, and also to the possibilities of elimination. In fact, the studies of this nature have yet to be made which will give us accurate information. I consider this contribution one which is not only stimulating but worthy of greatest thought.

Distribution of the Gastric Glands in Man and Animals. The area of the gastric glands can be mathematically determined, according to Miyagawa,¹⁰ by describing a circle, its center being at the pyloric end of the lesser curvature and its radius being equal to a certain proportion of the length of the lesser curvature. The pyloric glands represent that area covered by the circle, and the area of the fundal glands represent the rest of the area. The areas are similar both on the anterior and posterior walls. There is an area in certain animals somewhere near 1 centimeter in width in which there is a gradual transition of fundal and pyloric glands, but the glandular tissue is never mixed in the same tubule. In man and in the cat, the fundus glands have a wider distribution than in the guinea-pig and rabbit.

The Bacteriology of the Stomach and Intestines in Healthy and Sick Infants. Scheer¹¹ examined the stomach and duodenal contents of 43 infants. No bacteria were found in the healthy infants or only some of the enterococci. On the other hand, in 8 cases of dyspepsia involving the small bowel, the colon bacillus was found in the duodenum in 50 per cent, but in others no connection was seen between the dyspepsia and the bacteriology of the tract.

Theory and Technic for Determining the Acid Relationships of the Gastric Contents. W. Lanz,¹² states that the *actual acidity* may be measured by: (1) The standard electrometric method of Gaskell; (2) the calorimetric method (sufficiently exact for the clinician, especially juice poor in protein); (3) titration with phloroglucinavillin (gives approximate values only with small protein content and low HCl content—up to 1 per cent).

The “*true total acidity*,” or the true binding strength cannot be measured in the unknown mixture of gastric juice; we must be content to measure the *total acidity*, or the neutralization value, which in juice poor in protein is not very different from the true base-binding value. It may be measured by titration, with $\frac{1}{10}$ normal sodium hydroxide and phenolphthalein or naphtholphthalein as indicator.

The *potential acidity* cannot be measured directly but must be reckoned from the total acidity by subtraction of the actual acidity. This computation is not exact since the true total acidity is brought into the computation although this cannot be determined.

In practice he finds that: A simple calorimetric determination with an indicator, such as methyl violet or dimethylamidoazobenzol, gives only approximate results. But with a complete series of indicators (methyl violet dimethylamidoazobenzol, methyl red, p-nitrophenol, neutral red naphtholphthalein) and a gastric juice not too rich in protein or HCl (such as ordinarily results with the usual test breakfast) sufficiently exact values of the actual acidity may be obtained. At the same time the usual titration with sodium hydroxide and phenolphthalein or naphtholphthalein is made, and the “*total acidity*” (neutralization

¹⁰ Journal of Anatomy, London, October, 1920, **55**, 56.

¹¹ Jahr. b. f. kinderheil, Berlin, 1920, **92**, 328.

¹² Arch. f. Verdauungskr., Berlin, 1921, No. 4 and 5, **28**, 282 (abs. American Institute of Medicine).

strength) determined, which in juice not too rich in protein is almost the same as the true total acidity). If we subtract from this titration value the actual acidity determined by the colorimeter we get the *potential acidity*. These determinations define the acid relationships of the gastric juice and the technic is simpler than titration of the so-called "free" and "combined" hydrochloric acid.

For the definition of clinical conditions, there should be added to the calorimetric investigation the more exact electrometric estimation of acidity.

The Psychic Secretion of Gastric Juice. Since Pawlow's experiments on sham feeding, much has been said regarding the psychic secretion. This observer himself did not believe that the psychic secretion played such an important role in human economy, and various writers have emphasized the fact that the lack of this secretion resulted in little, or no, impairment of digestion. Some time ago, from the laboratories of the Jefferson Medical College, Philadelphia, the reviewer and Hawk carried on a series of experiments with the fractional tube in which it was possible to demonstrate clearly the influence of this secretion.

We now note the communication of Heyer¹³ in which the secretion was collected by means of a sound from individuals who were in hypnotic sleep. It is pointed out that these subjects paid no attention to the tube, but were susceptible to suggestion in various ways. In subjects in whom several teeth were missing, through which the tube was passed, chewing could go on without any interference. These experiments, with somewhat similar experiments performed in England, emphasize the importance of the psychic secretion. There is no question that this field will be much more thoroughly explored in the future and should lead to most interesting observations in disease. The following résumé is taken from an abstract of this important article.

The tests recorded in this paper were made on bread, milk and bouillon suggestions, and the secretory suggestion-values of each was determined by measuring the flow of juice, its acidity and digestive power.

The experiment was always begun by aspirating the gastric contents of an "empty" stomach until no more secretion could be obtained. The subject was then given the suggestion-meal with most specific information as to taste and amount. The "feeding" usually lasted two and a half minutes and the "meal" was always "eaten with great appetite." The same results were obtained whether these suggestion-meals were given after the hypnotic state or during sleep, and as the later method was more convenient it was finally used exclusively.

The flow of juice began five to twelve minutes after the "feeding," and it was then collected in five-minute periods and tested for acidity and peptic strength. Bouillon suggestion was followed by a rapid secretion which reached its maximum within five minutes and then fell off very rapidly. The bread curve also rises rapidly but to a relatively low height ($\frac{1}{5}$ of the bouillon curve). But it falls much more

¹³ Archiv f. Verdauungskrankheiten, Berlin, 1921, No. 4 and 5, 28, 227.

slowly to zero, the time being one and a half hours or longer. The milk curve rises more slowly and to a height midway between the bread and bouillon curves. It falls more slowly than the bouillon curve but more rapidly than the bread curve. None of the curves fall with an uninterrupted descent, but reach their zero by a zigzag rise and fall.

Essentially, the same variations were found in their digestive strength. Bouillon had very small protein-digestive value, a little more at the beginning than later. "Bread" juice digested protein more intensively and in larger quantity; "milk" juice had still greater digestive value.

No food differential values for acidity are given, but the acidity is said to have been increased by appetizing suggestions. For example, a patient with 20 per cent total acidity, and no free HCl, gave, after appetite suggestion, a total acidity of 28 per cent, and a free HCl of 5 per cent. On being told that dry bread tasted like bacon fat and that it was particularly good, the total acidity rose to 35 and the free HCl to 17.

It was essential to work on healthy persons. An epileptic on the day following an attack, showed sometimes no secretion, sometimes profuse irregular secretion. The effect of suggestion wore off after a time, the latent period became longer and the amount of juice less. But, after an interval of six to eight days' rest, the suggestion had its original strength.

Heyer considers that the view which attributes to psychic influences a greatly subordinated role in the digestion of civilized man as compared with that which Pawlow found they played in the digestion of the dog, has been shown by these experiments to be an error. Further experiments dealing with the influence of different psychical factors and also with determinations of acidity are promised.

Hyperacidity. Surmont's¹⁴ paper, according to most reliable abstracts, deals with the general consideration of hyperacidity. Red tongue, usually bad teeth, overindulgence in food, and particularly in meat, are given as symptoms. Emphasis is placed on the thorough examination of the digestive tract. Mention is made of the fact that, in a suspected case of appendicitis, it is desirable to take the temperature one hour after a walk. If there is an elevation of the temperature, the appendiceal condition is probably responsible for the symptoms. Worms, in this author's opinion, are hardly responsible for the condition. And it is to be recalled that occasionally a cardiac and a renal condition will give rise to the same symptoms. The same is true of tabes and spinal affections. Hysteria likewise will occasion confusion.

Achyilia Gastrica. THE ETIOLOGY OF ACYHILIA GASTRICA. In his work on gastritis Hayem points out the fact that the complete absence of hydrochloric acid is always associated with an alteration of the gastric mucous membrane. This might progress to complete atrophy. Einhorn, in introducing the term achyilia, comprises under this name a nervous disturbance with a total disappearance of the hydrochloric acid and pepsin. For him, the findings in gastritis were those of a gradual

¹⁴ Echo. Med. du Nord, Lille, April 2, 1921, 53, 133.

diminution of gastric acidity, with a maintenance of the pepsin and the overproduction of mucous. Martius, it will be recalled, considered chronic achylia as a congenital anomaly—in contradistinction to the secondary achylia associated with chronic inflammation of the stomach. This author and his collaborators favor the interpretation of Hayem. It is interesting to note, however, that as the role of achylia became more and more evident—particularly as the cause of gastrogenous diarrhea and some of the pernicious anemias—more and more interest was manifest in the study of these problems. Martius, in 1916, and his pupil in 1919, have brought further studies to defend their conception of the essential congenital nature of these cases. The fact that they are extremely frequent, and exist in many instances without any symptom whatsoever, would suggest such an origin. Furthermore, anatomical studies by these authors would seem to show no such gross degeneration of the mucous membrane as might account for the disappearance of the secretion. Two new arguments have been advanced in support of this theory: First, the demonstration both by Albu and Martius of achylia in infants. The second is the evidence accumulated by Albu, Jung, Martius, and Weinberg, of the presence of achylia in several members of the same family.

On the other hand, there are many arguments in favor of an achylia of exogenous origin. In 1917, Lange and Faber divided chronic achylia into two groups. In the one there is direct irritation of the mucous membrane by irritants in the ingesta—such as alcohol and various other toxic substances—or, again, the effect of a grossly improper diet. The other group represents the toxins through the blood stream. This is the case with infectious fevers, such as typhoid. In favor of the first group are the studies of Vogelius, who found that 50 per cent of alcoholics had achylia. He further cited several cases in which the individuals before the abuse showed normal acidity—but after several years of alcoholism they developed an achylia. Adison and Hallus found this in tachyphagic idiots. Furthermore, during the war, owing to the poorly prepared dietary, the incidence of anacidity was very high. Bohme found 36 per cent of 435 dyspeptic soldiers who showed an acidity which was very markedly below normal. The finding of an achylia with infectious fevers is by no means uncommon—this is true regarding typhoid, paratyphoid, dysentery, and typhus—and it is always during the convalescent period.

Faber¹⁵ mentions the association of enterogenous achylia. The presence of hyposecretion and achylia have been signaled in the terminal stage of pulmonary tuberculosis as well as pregnancy—particularly in its complications—such as eclampsia. Further evidence is given in this article that an achylia can be brought about by constitutional conditions. In one group of cases—those of Jacobsen—an intestinal infection preceded the development of achylia. We might add, also, to these the fact that 50 per cent of those individuals affected with Basedow's disease and the great majority of those cases associated with

¹⁵ Arch. d. Mal. de l' App. Dig., Paris, 1920, 10, 641.

chronic polyarthritis, show the same condition. This subject is one which will require much further study. The article which has just been reviewed is simply suggestive of the possibilities in this direction. We are of the opinion that the direct association of achylia gastrica with toxic substances will be demonstrated in the near future.

In the study of the interdigestive phase of gastric secretion, Rehfuss and Hawk came to the following summary and conclusions:

I. Normal digestive activity in the stomach comprises two periods interrelated with one another; one of gastric work in response to a stimulus which we call the digestive period, and the other the period of gastric rest between the work periods, which we prefer to call the interdigestive period.

II. We have attempted to enumerate the characteristics of the normal interdigestive or rest period on the basis of our previously reported findings on men, and Fowler and Zentmire's observations on women, together with our subsequent observations, in order that some basis might be arrived at for a normal mean to serve in the interpretation of pathologic data.

III. The interdigestive period reveals three phenomena: The first motor, in which peristole and tonal and hunger contractions supplant peristalsis; the second, a lessening in secretory velocity and a reduction of the titratable acidity to less than half of that seen in the digestive phase, and the third an alteration in the status of the stomach and duodenum during this period, which accounts for some of its characteristics.

IV. In health, a satisfactory balance is maintained between the digestive and interdigestive periods. In disease, on the other hand, this balance is ruptured and altered, and the interdigestive period may be completely obliterated—a condition comparable to incompetence in other organs of the body.

V. In a subsequent communication, we intend to discuss the characteristics of the residuum in disease, and suggest a basis for interpretation.

In a study of the titratable acidity encountered in normal individuals, Rehfuss and Hawk¹⁶ found the following results:

RESULTS OF EXAMINATION OF 924 COMPLETE CASES OF VARIOUS FOODS IN THE NORMAL HUMAN STOMACH.

Food.	Total number of cases.	Cases with acidity of 100 or over.	
		Number of cases.	Percentage.
Bread and cereals	82	6	7.3
Pies, cakes and pastry	89	35	39.3
Fish	82	75	91.5
Meats	203	156	76.8
Ice-cream and drink	48	10	20.8
Eggs	104	23	22.1
Nuts and fruits	94	34	36.1
Tea	139	27	19.3
Milk and cream	47	21	44.6
Candy	39	3	8.0

¹⁶ American Journal of the Medical Sciences, 1920, 160, 428.

NORMAL ACID FINDINGS (824 CURVES).

Three hundred and eighty-four cases out of 842 had an acidity of 100 or over.

Acidity of 200 or over	.	.	.	.	.	.	.	.	.	.	.	.	1 case
Acidity of 180 or over	.	.	.	.	.	.	.	.	.	.	.	.	2 cases
Acidity of 170 or over	.	.	.	.	.	.	.	.	.	.	.	.	4 "
Acidity of 160 or over	.	.	.	.	.	.	.	.	.	.	.	.	11 "
Acidity of 150 or over	.	.	.	.	.	.	.	.	.	.	.	.	35 "

Thirty-five cases in 842 had an acidity of 150 or over; all of these belonged to the meat, milk and fish group.

In conclusion, we may state:

I. Hyperacidity, as discussed in this article, does not refer to the subjective symptoms, but the objective finding of an actual increase of titratable acidity over normal.

II. Evidence is adduced to prove that the normal individual elaborates acid figures as high as those commonly associated with pathologic syndromes, and in our experience no acid figures found in disease have exceeded the figures which we have obtained under certain circumstances in health.

III. The average acid finding during the digestion of certain foods in the normal stomach was found to be within the range which is accepted by all clinicians as abnormal.

IV. There is a group of normal individuals, approximately 40 per cent, who constantly show the acid titration findings of so-called hyperacidity.

V. It is essential that our views on this subject be altered and that we accept first these normal findings as a basis for the interpretation of pathological cases.

VI. The introduction of very high acidities (0.5 per cent HCl) is followed by the activity of the autoregulatory mechanism which brings about a gastric optimum.

Miller, Bergeim, Rehfuss and Hawk¹⁷ have reached the following summary and conclusions regarding the digestion of candies, etc., in the stomach.

Large amounts (100 grams) of cane sugar or glucose in concentrated solution markedly depressed gastric secretion and delayed evacuation of the stomach.

Small amounts (10 grams) of cane sugar or glucose did not appreciably inhibit either gastric secretion or evacuation.

Candies depress secretion and delay evacuation in proportion to their sugar content and the amounts of them ingested. This tendency is influenced, however, by flavoring substances and particularly by added food ingredients such as milk, eggs or chocolate, which stimulate gastric secretion.

Candies should be eaten not before but after meals. Hard candies which must be sucked are preferable to cream candies for children

¹⁷ American Journal of Physiology, August 1920, **53**, 1-65.

because of the smaller quantity of less concentrated sugar solution derived from them.

Cane sugar and maple sugar elicited much the same response from the human stomach as glucose, although the possibility that the greater sweetness and less rapid absorption of the first mentioned sugars gives them a slight advantage is not excluded.

Soft candies, such as bonbons, soft creamy wafers and the interiors of chocolate creams, when given in 100-gram portions, exerted the same depressing action on gastric secretion and evacuation as concentrated sugar solutions.

Peppermint oil used as a flavoring agent delayed evacuation, while a strawberry fruit flavor appeared to accelerate it.

Chocolate appeared to stimulate gastric secretion as indicated by experiments on milk chocolate, chocolate fudge and chocolate creams, which gave higher acid figures than plain sugar candies. Stale chocolates remained in the stomach relatively long.

The sucking of hard candies introduced but a small amount of sugar into the stomach which was readily evacuated and exerted little depressing action on gastric secretion.

Chewing caramels gave rise to a more voluminous gastric secretion than cream candies, but evacuation times were about the same. Salt water taffy gave rise to less secretion, while gum drops left the stomach rapidly with little acid production.

Plain marshmallows remained in the stomach rather long, but after being toasted these confections left the stomach rapidly and gave rise to high intragastric acidities.

Licorice gave rise to a fairly abundant secretion and remained in the stomach for nearly three hours.

Sugared or buttered pop-corn developed a moderate acidity and left the stomach rather quickly.

The addition of honey to bread did not delay evacuation, although acid production was somewhat depressed.

Gastric Ulcer. Schönfeld¹⁸ protests against the undue frequency for operation for ulcer, and reiterates the fact that even the most complete operation has no influence on the predispositioned ulcer. It is this that we would emphasize; viz., that surgery is not a rational etiological cure of ulcer. It is simply the mechanical removal of the focus. By the broadest stretch of the imagination it is not possible to conceive of surgery curing the etiological factors which have produced it. If clinicians would bear this fact in mind and realize that surgery offers a cure in direct proportion to its ability to remove mechanical factors, there would probably be better clinical results so far as this condition is concerned.

According to Schönfeld, the indication for surgical interference in gastric ulcer are as follows: (1) An obstruction of the gastric contents as the result of pyloric stenosis or hour-glass contraction, as soon as persistent symptoms arise which prove refractory to any other kind of

treatment. (2) In perigastritis with adhesion of the stomach to neighboring organs, operation is the only method of treatment. The diagnosis of adhesions has been facilitated in recent years by roentgenographic methods with insufflation of oxygen or sterile air into the abdominal cavity. (3) Persistent hyperacidity, especially when associated with dilatation of the stomach and weakness of the gastric wall. Gastro-enterostomy, he states, is the operation of choice in these cases. Section of the branches of the vagus in the neighborhood of the cardia has recently been recommended, as the hypersecretion "and motor disturbances have been attributed to vagotonia."

TREATMENT OF GASTRIC ULCER BASED UPON MODERN CLINICAL, HISTOPATHOLOGICAL AND PHYSIOLOGICAL INVESTIGATIONS. This contribution is along the line of thought which Smithies¹⁹ has been in the habit of evolving for some time. It represents the conception of a great clinician who has been in close contact with not only the clinical aspects of ulcer but also the pathological manifestations. He divides this contribution into two portions, first the problem, and, secondly, the treatment.

In the discussion of the problem, several headings come in for detailed discussion. From a clinical standpoint the original evolution of ulcer is discussed, and it is stated that 84 per cent of cases reveal a peculiar periodicity which often manifests itself by recovery and relapse frequently wholly independent of the type or duration of treatment. The author is entirely correct in his assertion that acuteness of symptoms does not necessarily indicate pathological changes in the focus, because acute manifestations can be engrafted on chronic inflammatory tissue.

Another point in this communication is the fact that it is a disease which rarely affects individuals not already affected with other disturbances, and finally the pertinent suggestion that it is of universal distribution. He gives a short summary of the causes of ulcer—bacterial, toxic, burns, extrinsic poisons, circulatory disturbances, artificial spasm or stenosis, and mechanical trauma—and attempts to group, from an etiological standpoint, the factors associated with 522 cases of proved ulcer. In 33 per cent of cases there were chronic and acute infections; in 14.7 per cent there was arteriosclerosis; in 13 per cent there were autonomic disturbances; in 11.3 per cent chronic anemia; 7.8 per cent syphilis; 5.2 per cent vagus or splanchnic hypofunction; in 5.2 per cent postoperative, in 4.2 per cent infection, in 3.4 per cent endocrine, and in 1.5 per cent injuries. The criticism to this arrangement is the fact that a similar association can be found with almost any abdominal disease. Nor is there to be found any preponderance of factors etiologically associated with ulcer.

On the other hand, Smithies has unquestionably brought out the most important single factor that we know of regarding ulcer production, *viz.*, the fact that ulcer is the expression of some general systemic condition with its local expression in the mucous membrane of the stomach. In spite of the many experimental studies regarding ulcer

¹⁹ International Journal of Gastro-enterology, July, 1921, No. 1, 1, 13.

formation, but one thing stands out clearly, namely, the fact that a certain portion of the mucous membrane of the stomach loses its viability and it is unable to resist digestion. Whether this be a focal infection or the elimination of a poison, or a localized circulatory disturbance, the evidence points to the fact that something has interferred with the ability of the cell to continue its function, and that only certain circumscribed areas of the mucous membrane are affected. No satisfactory explanation so far has been forthcoming, even though the so-called bacterial localization is a very beautiful one, and, until we find an exact explanation for ulcer production, we can hope for no form of rational treatment.

From the standpoint of pathology, it is simply a matter of interest to note that fully two-thirds of all gastric ulcers occur in that portion of the stomach which has little or nothing to do with the elaboration of hydrochloric acid, and it is likewise of interest to note that the majority of ulcers occur in that portion of the gastric wall which exhibits the greatest circulatory, muscular and nervous activity.

From the physiological standpoint, the mechanical action of the gastric juice naturally is an extremely important one. In Smithies' studies of 500 cases, in only 40 per cent did he find a free acidity above 0.25 per cent, in 35 per cent the acidity was well over normal range, and in the remaining 25 per cent the acidity was reduced or absent. On this basis, Smithies has taken the stand that the acid factor is not an important one in ulcer production. In fact, we know that he stands as the great exponent of this fact. This is directly in line with the studies made by Hawk and myself, and already commented upon, in which we demonstrated with all varieties of foodstuffs that the acid of the gastric juice is far above the commonly accepted normal standpoint, and that about 40 per cent of all normal people show high acid figures in some portion of the curve. It is likewise of interest to note that, in a résumé of gastric ulcer made some three or four years ago, we found only 38 per cent showing unusually high acid figures. However, we are not inclined to agree entirely with Smithies. It seems to me that the present state of this subject would indicate that the gastric secretion is not the primary cause of ulcer production, but is the great contributing cause to ulcer extension and ulcer chronicity. In other words, we do not believe, and experimental study will bear us out, that a small increase in acid can bring about ulcer production.

On the other hand, there is, apart from the etiological cause which we do not know, no more important purpose to be obtained than a reduction or neutralization of the existing secretion. There is nothing to be gained by taking a dogmatic stand on a question of this type in which we have no complete information nor even a satisfactory explanation of this action. It is unquestionably a mistake to ascribe everything to gastric acidity. It is an equally great mistake to deny the importance of the gastric secretion, and therefore, it seems to us we must bear this point in mind. The motor conditions are likewise of great importance but here again motor and secretory functions are so intimately linked together that it is difficult to have a disturbance in motor function

without a corresponding alteration in secretory manifestations. The phenomena of gastric motor function are now very well known and need no discussion at this point. One thing, however, seems to be more or less clear and that is the fact that gastric motor function is a highly organized series of phases dependent upon many factors, not merely the gastric contents but many factors entirely outside of the stomach affecting it through the nervous mechanisms.

We question whether the acid control of the pylorus will stand the test of further investigation. We likewise question the fact as to the explanation of ulcer simply on the basis of motor phenomena. At this point it is now pretty clear that gastric ulcer is usually associated with gastric hypermotility, and ulcer of the duodenum is associated with gastric hypermotility. Smithies mentions the well-known fact that gastric secretions and gastric function are greatly influenced by the kind of food ingested, and mentions the fact, as shown by Khingine, that protein causes the secretion of 50 per cent more gastric juice during the first four hours of digestion than when carbohydrate is fed. This subject is likewise, from our studies, one of great importance. There is no question of the selective action of the stomach toward various foodstuffs, and the studies which we have made indicate that the stomach acts in a highly selective manner toward each variety of food.

In discussing this problem, Smithies mentions the principles involved in the treatment of ulcer. We all realize today that the first fundamental principle in the treatment of all great infections of the abdomen, as well as ulcer of the digestive tract, is the removal of any focus of infection whether it occur in the head, nose, throat or even in a more serious degree in the gall-bladder, appendix, tubes, and so forth. In the last five years we have gradually reached the point where the removal of focal infection is preliminary to the treatment of almost any chronic disease. It seems to be the rule today that if an ulcer is associated with much deformity or obstruction, that ulcer is a surgical ulcer. However, there is no means at our disposal at the present time to determine on the cursory examination how much deformity is due to actual scar formation and how much is due to periulcerous edema, inflammation, and muscular spasm. We do not believe, from our own experiments, that a single study with the *x-ray* can adequately demonstrate the extent of scar formation. The result of the case, coupled with the associated findings, would suggest the disease so far as this is concerned, and we have repeatedly seen large and extensive deformity almost completely disappear under complete rest and starvation ulcer treatment. Only recently one of us saw a very pronounced niche, with an air bubble indicating perforated ulcer, for which we advised immediate operation. The patient, however, would not submit to this form of treatment, and was placed by another physician under the starvation treatment. I have seen the *x-ray* of that case and must confess the niche has almost disappeared, showing to what degree medical treatment will ameliorate that condition. Furthermore, while I believe that the patient is not out of danger, he is in a better condition for operation than he was at any

previous time. There is no question, however, that the less deformity present the more liable medical treatment is to succeed.

The outline of treatment suggested by Smithies contains no unusual suggestions. In fact, as we have already enumerated, it is the usual method of treatment with the exception of complete neutralization. It consists of the usual rest in bed and suspension of foods, of gastric lavage and no medication which might be irritating. He insists on complete starvation from three to seven days, ordering the patient to chew paraffin wax for fifteen minutes of every hour. For rectal feeding he employs 1 ounce of 50 per cent alcohol and 1 ounce of glucose with sufficient normal salt solution to make 240 cc. That is given by the Murphy Drip at 30 to 60 drops a minute, and 10 drops of tincture of opium are given with each enema. Feeding is begun with liquids in small quantities, 4 to 6 ounces every hour, and is largely carbohydrate. He begins with barley water, rice, gruel, then cream of wheat and cream vegetable soups. Ordinary milk is not given, and only parboiled milk is permitted. Smithies has put himself on record as opposing the use of alkalies in the treatment of ulceration. We are, however, not in favor of this attitude, not because there is not some truth in it but because the selection of the proper alkali does not result in over secretion. It is true, as we and others have pointed out, that the use of bicarbonate of soda or the soluble alkalies is followed by primary neutralization, and, second, by marked stimulation which in a condition like ulcer may be a great harm. On the other hand, the alkalies, such as the salts of bismuth, exert a long-continued, slow-acting, neutralizing action, with little, or no, after-stimulation. Therefore, proper combinations of alkalies will offer considerable relief. Belladonna is usually advised for spasm, and the author goes on record as suggesting the use of orthoform in 10 grain doses in warm water as an efficient local anesthetic, a fact which we very greatly question. If there is excessive acid, he recommends 5 to 10 grains of calcined magnesia or warm Carlsbad water, and 1 gram of Carlsbad salts to 1 quart of water. For acute hemorrhage, prompt lavage of the stomach with water at 110° is recommended. In the care of the bowels, a soap suds enema every second day, and morning doses of sodium phosphate or Carlsbad salts in hot water are recommended. After the second week, liquid paraffin may be used. Furthermore, the use of iron and arsenic is recommended for anemic cases.

Means of Reducing the Acid Secretion of the Stomach. From his studies on the secretion of hydrochloric acid, Kelly²⁰ has shown the elaboration of this acid to be due to certain osmotic phenomena and is merely a matter of electrolytic dissociation. In treating gastric ulcer, therefore, which is probably due to an excess of this acid, the diet must be fluid in form and contain no meat or its extractives, acids, condiments or carbonated drinks. On the other hand, it is desirable to have substances which bind the acid, such as milk. Fats can be added to the diet and can be stored in the various gruels and can be given into the empty stomach. It was pointed out in this connection that salt must be

²⁰ Arch. f. Verd. krank., 1920, Nos. 5-6, 26, 287.

restricted in the dietary. Charcoal and kaolin have little value because they are unable to fix enough acid. The carbonated bismuth preparation is the best, but it must be given in large amounts before meals. If there is a tendency for the reduction of gastric evacuation, magnesia may be given. Hydrogen peroxide is very energetic in reducing the gastric secretion, and it promotes the formation of mucus, but in true stenosis of the pylorus, and also in the same type of duodenal ulcer, lavage will have to be performed as well as the administration of atropine. This paper gives the results of a number of experiments, both on animals and man, and discusses the mechanics of the formation of the acid secretion based on these experiments.

Gastric and Duodenal Ulcer. MEDICAL TREATMENT OF DUODENAL ULCER. Mendel,²¹ in this communication, calls attention to the fact that there is to be found, in all cases of duodenal ulcer just to the right of the linea alba and midway between the costal arch and the umbilicus, a tender spot the size of a half dollar which is painful on the slightest percussion. This is rather sharply defined because precussion just outside of this region gives rise to practically no pain. He claims that as the ulcer heals the tender spot becomes smaller, and therefore emphasizes the value of this tender spot in determining the progress of ulcer healing. Mendel has treated over 100 cases in the last twenty years, and lays stress upon absolute rest in bed for from four to six weeks coupled with constant use of hot, moist compresses. At first the patient is put on a milk diet, but, as the tender spot becomes smaller, the dietary is greatly enlarged to include the mashed starchy vegetables with plenty of butter.

Regarding the control of the hyperacidity, Mendel uses the following formula which, it will be recalled, is similar to the formula of Bourget, of Lauzanne. It is as follows: Dried sodium sulphate 30 parts, dried sodium phosphate 30 parts, dried sodium bicarbonate 40 parts. One teaspoonful of this mixture is dissolved in a wine glass of water and is to be taken 4 times a day before meals. He claims that the sodium phosphate is an extremely important ingredient, quieting the over excitable vegetative nervous system.

Schutz²² discusses the intermittency in the course of gastric and duodenal ulcer. He believes that the characteristics in ulcer history is one of the most important features in making a differential diagnosis. Furthermore, there is a difference in the histories of gastric and duodenal ulcers. The duodenal ulcer is much more likely to flare up during the cold season or during the spring and fall, whereas ulcer of the stomach appears at irregular intervals. Furthermore, there is considerable difference in the way the remission in these two disease processes occur. In duodenal ulcer there is almost a complete relief from symptoms, while in gastric ulcer the patient is liable to be pursued with phenomena of indigestion.

DIAGNOSIS OF GASTRIC ULCER. This article is devoted to the diagnosis of ulcer of the stomach, and, according to Hardisty,²³ the history

²¹ Deutsch. med. Wochenschr., April 15, 1920, No. 16, 46, 433.

²² Wien. klin. Wchnschr., April 15, 1920, No. 16, 33, 337.

²³ Journal of Canadian Medical Association, January, 1921.

on many occasions fails to reveal the presence of the lesion. In fact, the widest variations in symptomology are encountered, and in most instances they are those which accompany hyperacidity. In 60 per cent of cases pain was worse after taking food—in 10 per cent the pain was worse before eating, but cases were encountered in which pain was either constant, or not at all affected by the taking of food. Vomiting was encountered in one-half the cases. It was interesting to note, however, that pain was a constant symptom, and with these cases the history was usually one of a series of digestive disturbances, with little evidence of a complete return to normal.

Nearly always, well-defined tenderness is found in practically all patients in the upper part of the abdomen, usually in the epigastrium. The degree of tenderness differs with the patient, and there are no reports of its being confined to a circumscribed area. In regard to acidity, the widest variations are said to exist. The acid has been shown in many cases to be normal or even subnormal. Great emphasis is laid by many authorities upon the existence of occult blood in the feces.

The two most important methods of arriving at a diagnosis are the barium meal and the *x*-ray. Too much emphasis cannot be placed upon the importance of the screen examination as a preferred method over that of the skiagraph.

By fluoroscope examination one may judge more easily the evacuation-time of the stomach, the size, conformation and position of the stomach, the type of peristalsis, and duodenal cavity.

It is an important fact that gastric ulcer, as a rule shows no roentgenologic changes—but one may obtain marked information in the subacute and more chronic cases—but this depends, mainly, on the anatomical lesions produced by the ulcer during its growth.

No one method can be used for a definite diagnosis of gastric ulcer, and only by careful consideration of all symptoms and conditions can a comparatively satisfying conclusion be reached.

STUDIES ON GASTRIC AND DUODENAL ULCER. In previous studies on ulcer, this author presented evidence that two factors are necessary to the production of ulcer of the chronic type in the dog. (1) A temporarily lowered bodily resistance; (2) temporarily altered mucous membrane manifested by hypoacidity or achylia.

In a general way, the theories which have held most sway as explaining the formation of chronic ulcer are: (1) infection, presumably by the blood stream, or focal infections of the mucous membrane; (2) the corrosive action of the gastric juice; (3) a localized trophic disturbance; (4) a general condition of autolysis which may play the initial role.

Most observers agree with Bolton that the lesion begins acutely and also that most of the acute lesions which occur heal rapidly. It is useless to discuss here the time-honored résumé of the different methods by which ulcer has been produced. Such a discussion serves no useful purpose, inasmuch as it simply indicates the multiplicity of factors which have been linked up with chronic ulcer. Ivy²⁴ points out, however,

²⁴ Journal of the American Medical Association, December 4, 1920, No. 23, 75, 1540.

that in those animals in which it was possible to produce chronic ulcer it was noted that the animals were diseased or cachectic, or that there was no free hydrochloric acid in the gastric contents. This lack of free hydrochloric acid made it possible for bacterial implantation to take place on an abraded mucosa with some assurance of its fixation. Certainly, as he points out, a stomach which had an altered secretion is a pathological stomach. Given therefore altered systemic resistance, and an altered mucosa and an abrasion, we have the factors which make it possible for bacteria to be swallowed or to be transferred by the blood stream and implanted on the mucosa. Furthermore, as he observes, it is reasonable to suppose that once the base and edges of an acute lesion become indurated, an altered blood supply will tend to produce chronicity of the lesion.

In order to gather more data on this question, an operation was devised for producing a pouch in the pyloric portion of the stomach and the study of (1) the effect of the exposure of the entire mucous membrane of the pyloric antrum when exposed to the exterior; (2) the effect of the manipulation and infection of an acute ulcer at its healing time; (3) the occurrence of duodenal ulcer following gastroduodenostomy in the dog observed.

In considering the first problem, the effect of the exposure of the antral mucous membrane, it was noted that after exposure of six to ten months, the mucous membrane was normal in every way, and, furthermore, abrasions healed rapidly. The second problem, the manipulation of the ulcer-bearing area, which was performed by massaging the edges and bases of the ulcer with bread crumbs, dry cotton, and the fingers until marked congestion and bleeding occurred, each massage lasting from ten to fifteen minutes produced a delay in healing-time similar to the delay observed in acute experimental ulcer as reported by Bolton, Friedman, Hamburger, and the author. This is due chiefly to the manipulation of the edge which prevents the manipulation of the mucosa cells at the edge of the ulcer from getting a foothold on the base. In testing out the effect of manipulation and infection, slant cultures of bacteria and also pus were massaged into the margins of the ulcer in the same way. This procedure was tried on four ulcers, in 2 cases with *streptococcus viridans* and in 2 others the *staphylococcus aureus* from subcutaneous abscesses in the dog were used. *Streptococcus hemolyticus* from a case of septicemia was also used. From these experiments, in which the acid inhibitory action on bacteria was ruled out, there was no delayed healing. Duodenal ulcer following gastroduodenostomy in dogs, associated with emaciation, nausea and vomiting is a point worthy of notice inasmuch as this author points out the possibility of gastro-jejunal ulcer as being due to injudicious use of the gastro-enterostomy clamp.

PROBABLE IDENTITY OF HYPERACIDITY AND PEPTIC ULCER. Campo,²⁵ after an experience of many years with thousands of cases, in an extremely instructive article comes to the conclusion that gastric hyper-

²⁵ Arch. f. verd., June, 1921, 28, 69.

acidity and gastric ulcer are more or less identical conditions. The differential diagnosis which rests upon the finding of blood is an uncertain one, inasmuch as gastric ulcers bleed intermittently. However, as the author stated, the treatment for both conditions is the same. It will be recalled that certain continental authors, like Bickel and Rubow, associated hyperacidity with excessively rapid evacuation of the stomach. These authors believe that the increased amount of hydrochloric acid is due to the retention of the gastric contents, probably the results of a previous ulceration. Campo certainly does not believe that the pain of ulcer is due to the peristaltic contraction, such as is commonly the belief in this country. He mentions the fact that in many screen examinations most active peristalsis was present, and evidence of muscular tension without the slightest amount of pain on the part of the patient. This attitude is one of great interest and has been a battle ground for years. In this country, from the more thorough examination in the normal output to the comparison of normal figures with those encountered in ulcer, we do not believe that the assertions of Campo can be confirmed. A clinician of his long and varied experience, however, can scarcely take a stand such as he has in this paper without incurring the obligation of serious thought as to the correctness of his views. We feel, however, that this subject will not be solved so much by the clinicians as by the gastric chemist who checks up every abnormal finding with a careful study of the normal. We know that hyperacidity as a symptom is present in many other conditions beside that of ulcer, nor do we believe that these conditions are identical.

Parturier²⁶ discusses the *differential diagnosis of duodenal ulcer*. The general clinical manifestations are described. Mention is made of the fact that when pressure is exerted over the region and the patient is asked to take a deep breath, there is no increase in pain as is often seen in gall-bladder conditions. The x-ray signs are the indirect sign of a small notch which may be filled with bismuth, spasm on the level with the ulcer, distortion of the cap and even the formation of a small diverticulum, indirectly excessive gastric tone, increased peristalsis and rapid evacuation of the stomach. The other chemical laboratory procedures are as follows, the gastric hyperacidity, the thread test, duodenal intubation, etc. This author maintains that there are several atypical manifestations of the disease. First, a latent form; second, a pseudo-hepatic form; third, an appendicular form; fourth, a gastric form; fifth, an intestinal spasmoid form; sixth, a pancreatic form; seventh, the intermittent form; eight, the inveterate chronic form, usually with pronounced pain not relieved by any method of treatment. Mention was made of the many conditions which may simulate duodenal ulcer. The fact remains, however, that the condition is one which may be extremely simple in its diagnosis or may be very complex, owing to its association with the many surrounding organs.

Lutz²⁷ discusses the importance of *occult blood in the diagnosis of gastric ulcer*. This author points out the necessity of ruling out adventi-

²⁶ Rev. de med., Paris, April, 1921, **38**, 214.

²⁷ Arch. f. klin. chir., May 24, 1921, **115**, 780.

tious sources of blood from the food ingested, from the oropharynx and from the lower bowel. A series of negative reactions is presumptive evidence of the absence of cancer, but it does not rule out suspected ulcer. In this series of cases an examination of the stool was always made before an intubation of the stomach so that any trauma from the tube might be eliminated. In 32 cases of operatively demonstrated ulcer, 27 showed blood in the stool, 5 gave a negative reaction and showed only stenosis and scar tissue at the operation. Comparing the constant presence of blood in the stools in cancer cases, the ulcer cases show a variation in the output of blood from negative to positive and with the presence of old and new blood at various intervals. The presence of blood in the stools after operation or after medical treatment means a recurrence of the condition, while the persistence of blood would probably indicate malignant degeneration. About 90 per cent of ulcer cases, according to this author, give a positive reaction in the stool and gastric contents.

Babowiski²⁸ tested out the importance of *Mendel's percussion sign in digestive cases*. In over 100 patients with various disorders, he found that percussion pain was found in other conditions beside ulcer. When the zone is round or oval, it is usually not at Mendel's point, and when it is at Mendel's point the disturbances are usually due to some other condition beside ulcer. This author is of the opinion that Mendel's sign can therefore give no more information than the evidence of percussion pain, and in his cases there was sensitiveness to pressure, even when no percussion pain could be found.

Federmann²⁹ discusses the *etiology and treatment of gastric ulcer*. Mention is made in this article of this essential fact regarding the etiology of ulcer that it occurs in those whose constitutions are predisposed to ulcer formation. It is noted, furthermore, that while many forms of small erosions may bleed profusely, nevertheless an ulcer of the stomach of the typical type may evolve with little or no hemorrhage and show no tendency to heal. The hemorrhage from erosions, however, heal rapidly but there are also cases of gastric ulcer which heal more or less slowly. This author believes that the removal of the ulcer is by far more advantageous than gastro-enterostomy.

Rehfuss and Hawk have the following suggestions to make regarding treatment of ulcer:

I. There is unquestionably a form of ulceration in which there is no evidence of alteration in either secretion or motor function. The assumption, therefore, is that under these conditions the greatest attention must be paid to the subject of focal infections, the correction of toxemias (intestinal, etc.) and habits, particularly dietetic.

II. On the other hand, there are obviously a certain group of ulcer cases in which there are definite disturbances in function, particularly in the direction of vagotonia with its attendant hyperacidity, hypersecretion, and pylorospasm, and in alterations in motor function. The assumption is that these alterations are unquestionably the dominating links in the chain establishing the chronicity of ulcer. Therefore we

²⁸ Arch. f. verd., June, 1921, **28**, 103.

²⁹ Berlin klin. Wehnschr., May 23, 1921, **58**, 542.

are compelled to break its vicious circle, particularly through dietetic means.

III. Prolongation of the fasting period or the interdigestive period is undoubtedly the most favorable means of inducing gastric rest, and it is universally admitted that complete rest is most conducive to ulcer healing. This is accomplished by starvation and rectal feeding. The only cure which completes the starvation period is the one in which white of egg and butter are given following the starvation cure, and rectal feeding is kept up.

IV. We have discontinued the use of nutritive enemata and substituted the Murphy drip by bowel with nutrient solutions. It is possible to introduce 1500 calories in this way far more effectively than by the enemata, and the treatment can be continued and discontinued at intervals with much less discomfort than is entailed in former methods.

V. Surgery aims at the drainage cure, and if this be the paramount point to be attained we can attempt to accomplish it dietetically by a diet which is simply composed of those substances which are rapidly evacuated from the stomach. Inasmuch as gastro-enterostomy finds its greatest usefulness in obstruction, so these methods of diet are indicated in just such cases. It is not true, however, that gastro-enterostomy is uniformly followed by a reduction in acidity. These remarks do not pertain to excision of the ulcer.

VI. If the question is the reduction of acidity, unquestionably the diet should be preponderatingly carbohydrate, with emphasis laid upon cereals, vegetables, and bread. It is not true that the free acid is markedly reduced by the administration of meat. On the other hand, the free acid figures run comparatively high after the administration of meat.

GASTRIC ULCER OF THE TABETIC TYPE. Savignac and Alivisatos³⁰ discuss a form of ulceration of the stomach resembling tabetic crises. In other words, it is a form of ulcer, non-specific in type which is characterized by gastric crises accompanied by longer or shorter periods of severe pain, often persistent and incoercible vomiting, with a sudden and very severe beginning and as sudden ending, and, finally, with intermittent periods of complete repose. We all know and have met with forms of gastric ulceration characterized by periods of progressively severe pain and vomiting, which usually terminate gradually and are followed by periods of relative calm, but the characteristic thing about the above form of ulceration is its extremely severe and sudden evolution and its absolute cessation during the intervals between the attacks.

These authors give in detail the history of 3 of these cases and discuss the meaning of this type. While this form in the suddenness of its evolution resembles in a striking way tabetic crises, there is no question in these cases that tabes does not exist and that the condition is one of a special form of ulcer. Mathieu, Hayem, Lion and Einhorn, in their work, have all called attention to forms of ulceration which are of this type, or, rather, gastric ulcer associated with painful crises.

³⁰ Arch. des Mai. de l'App. Dig., No. 2, vol. 11, p. 6.

Carnot and Mlle. Bruyere discussed before the Société Médicale des Hôpitaux of Paris this same question with an attempt to determine, (1) do tabes and ulcer ever exist together? (2) Is it possible to have ulceration alone in the absence of tabes, but with pseudo-tabetic crises? (3) The question of a tabetic form of crisis in the absence of ulcer. We know that the first possibility can exist. Regarding the second possibility, the one under discussion in this paper, has received rather frequent attention in the literature. While certain other diseases of the nervous system, such as disseminated sclerosis and syringomyelia, are capable of provoking attacks, nevertheless, with the exception of cholelithiasis, appendicitis, and conditions of that type, there is nothing in the course of this condition to explain it. Mathieu reported a case of gastric crises, non-tabetic in type which he associated with the migraine group. Soupalt and Remond, of Metz, were of the opinion that there was an essential form of gastric crises, which occurred in the absence of demonstrable tabes, gastritis, or ulceration and which was dependent on some unexplicable nervous cause. On the other hand, Rafinesque in his thesis (Paris, 1912) came to the conclusion that gastric crises represented an incipient monosymptomatic form of tabes, if other signs of that disease were lacking. Hemorrhage alone will not differentiate these cases, as hemorrhage is known to occur in the course of true tabetic crises. The pain is more acute, more spasmotic, and less likely to assume the girdle-like distribution and sensation of enormous weight which is encountered in true tabetic crises.

From the standpoint of physical examination, there are distinct differences. In the crises due to tabes, the physical examination of the stomach is negative, the abdominal walls are soft, and there is a suppleness and perfect indolence so far as gastric manifestations are concerned during the intervals. In the form due to ulcer, the reverse is the case, and it is possible to demonstrate in the epigastrium an area of increased sensibility or hyperalgesia and often slight muscular rigidity, particularly if there has been perigastritis. Furthermore, on laboratory and x-ray examination, it is possible to demonstrate all the signs of ulcer. Furthermore, there is a marked difference therapeutically; in the tabetic form, intragastric medication has little effect, while in the ulcer type the maximum effect is seen with alkalies, belladonna, rest, and a properly arranged dietary. In fact, in a true form of gastric tabes, none of these measures, with the sole exception of an injection of morphine hypodermically, offer relief. It is even possible in the ulcer type to avert attacks by continued precautions in the line of diet and medication. Naturally, in every case the Wassermann reaction and, if necessary, lumbar puncture, together with a careful search for the physical signs of the disease, must be carried out.

Many conditions must be considered in analyzing the question of true gastric crises. Not only do they occur in tabes, and in syringomyelia, as has been above mentioned, but cerebral tumors, and medullary compression produce crises. There are also forms of hysterical crises which must be borne in mind. The periodic vomiting of Leyden, according to Hayem, is an obscure phenomenon which Rafinesque would assign to tabes.

The crises of pain in the stomach encountered in appendicitis, biliary lithiasis, a form of colitis (a forme appendiculaire of Mathieu), pancreatic lesions, the abdominal anginas, renal stone, and reflexly pelvic conditions are all capable of inducing severe crises in the abdomen. Migraine and the gastroxynsis of Rosbach alone remotely resemble gastric crises of tabes. Loeper and Binet have described the gastric crises of oxalurics, which, however, have none of the intensity of the attacks described in this paper, and Hayem has called attention to the gastric crises accompanying the hypertrophic form of gastritis in alcoholics.

The possibility of a neuritis of the pneumogastric nerves is discussed. The type of ulcer crisis described in this paper occurs practically in one form of ulcer, namely, the chronic type. The reviewer does not believe that the type described by these authors is uncommon. In fact, he has seen several clean-cut cases of ulceration of the duodenum, which, in his judgment, is the most frequent form of ulceration, with acute manifestations of the type described followed by complete response, and, while reviewing this article, several of these cases come to mind. We do not believe, in view of a complete roentgenographic and chemical examination, that it is difficult to make a differential diagnosis, although there are sudden and severe forms of epigastric pain in which no logical cause can be assigned. It is the form of gastric crises in which no evidence of either ulceration or tabes can be demonstrated which presents the principal difficulty in analysis. We would point out, furthermore, that forms of complete gastropasm, sudden, very severe, and as suddenly disappearing, are known which would admirably answer the description of these cases. That gastropasm can occur as readily with ulcer, as with other forms of upper abdominal disease, is extremely probable.

Blood-sugar Tolerance Test as an Aid to the Diagnosis of Gastric-Intestinal Cancer. Friedenwald and Grove³¹ point out that a high blood-sugar content in carcinomatous cases has been known for many years. Many observers have worked on this problem but it has generally been considered that this test has been in no way a specific for carcinoma. In fact, like the question of blood-cholesterol and gall-stones, so with blood-sugar, an increase has been found in many conditions other than carcinoma. That it is so constantly associated with carcinoma is, however, a point of interest. These authors followed the method of Hamman and Hirschman, as well as that of Rohdenburg of giving, after a nights' fast, 100 grams of dextrose thoroughly dissolved in 300 cc of black coffee without additional sugar. The blood was withdrawn for examination by puncture from the arm vein just before examination and again in forty-five minutes and one hundred and twenty minutes after the administration of the dextrose. The blood-sugar was examined by the Epstein apparatus.

There were 32 case of gastro-intestinal carcinoma studied, and the conclusions of the authors were as follows:

- I. There is present in carcinoma of the digestive tract a rather

³¹ American Journal of the Medical Sciences, vol. 160, p. 313.

characteristic curve of sugar tolerance which differs somewhat from that observed in carcinoma of other regions of the body. The curve of this affection usually presents a high sugar content even in the fasting state, followed by an initial rise up to 0.24 per cent or higher within forty-five minutes after ingestion of the dextrose, remaining at this level for at least one hundred and twenty minutes, and at no time during this period falling below 0.20 per cent.

II. The sugar tolerance is rather distinctive, so that it may render valuable assistance in a large proportion of cases as a differential diagnosis between carcinoma and other diseases of the digestive tract.

III. The opportunity has not yet been afforded to test a sufficient number of cases of carcinoma of the stomach and intestines according to this method, so that, as yet, the value of the test as an early diagnostic agent has not been established; nevertheless, as positive curves occur equally whether cachexia exists or not, or whether the extent of the involvement be large or small, the authors are under the impression that the results may be quite definite even in the early cases of the disease. This question, however, requires further study.

IV. Finally, while they fully realize that this test is not specific of carcinoma and cannot be relied upon alone without entering into the clinical aspects of the disease, and that there are cases of carcinoma in which negative findings occur or non-malignant conditions in which the results are positive, nevertheless, we are of the opinion that, when properly performed, the blood-sugar tolerance test may be of considerable diagnostic help in obscure cases of carcinoma of the gastro-intestinal tract.

Acute Dilatation of the Stomach. Holcomb³² claims that early and repeated lavage of the stomach will do much to save cases of acute dilatation of the stomach. In well developed cases, it is advisable to give at least one trial lavage after the first material which is obtained from the stomach is clear, and to observe the other precautions, such as posture and proper medical treatment. Surgery is only indicated in these cases when there is evidence of obstruction, and here these methods will naturally fail.

Analysis of Vomiting. Chimene³³ divides the subject of the analysis of vomiting into two major divisions, those due to disturbances of the gastro-intestinal tract and those due to nervous conditions. The former include the various forms of esophageal obstruction, esophagitis, stricture, carcinoma, and the organic diseases of the gastric walls, as well as certain functional disturbances, gastritis, ulcer, cardiac obstruction, cardiospasm, hour-glass stomach, pyloric obstruction (*ileus*). Among those conditions enumerated under the heading of the nervous system, are organic diseases of the tract, such as tabes, brain tumor, cerebral hemorrhage, cerebral concussion; toxic vomiting through irritation of the vomiting center (measles, scarlet fever, pneumonia, typhoid fever, catarrhal jaundice, chronic infections, malaria, acute and chronic infections such as those due to ether, the vomiting of pregnancy, cyclic vomiting); sea-sickness; gastric neuroses; neurosis, hysteria.

³² Minnesota Medicine, October, 1920, No. 10, **3**, 486.

³³ Journal of the Medical Association of Georgia, May, 1921, **10**, 434.

The necessity of analyzing symptoms is apparent to every clinician and it is urgently necessary that we classify our symptomatology into a working basis susceptible to ordinary practise. While the appearance of the ordinary forms of vomiting is well known, particularly when associated with other phases of the case, the likelihood of overlooking other forms of vomiting is frequently due not so much to a lack of knowledge of the subject, but the inability to recall the other causes for this symptom.

Strauss³⁴ discussed the general subject of the *x-ray examination of the digestive tract*. He points out the fact that it is especially with duodenal ulcer that the *x-ray* accomplishes the most good. He mentions, as the indirect symptoms of this condition, ptosis, marked exaggerated peristalsis, open pylorus, unduly rapid passage of the stomach contents into the duodenum, the presence of a permanent gray shadow next to the deep black shadow of the stomach, the presence of a painful spot in the duodenum and a small residue in the stomach six hours after food is taken. It is pointed out that the ordinary ulcer of the duodenum occupies the proximal portion near the pylorus, while the stenosing ulcers occupy more frequently the distant portion of the duodenum. In the latter type of ulceration, it is pointed out that dentate filling defects are characteristic of that condition.

DISEASES OF THE DUODENUM.

Errors in the Diagnosis and Treatment of Duodenal Ulcer. Dunham³⁵ gives a general résumé of this subject and considers the history the most important single factor, but emphasises the fact that no diagnosis of duodenal ulcer should be made without a thorough general examination which includes the gastric contents, stools, urine, a blood count, a Wassermann test, and, most important of all, the *x-ray* examination of the chest and abdomen. This author claims that there are no chemical changes in the chyme which are typical of uncomplicated duodenal ulcer, and he makes the unusual statement that the presence of occult blood in the stools or gastric contents has no diagnostic value. We very much question whether this statement should go unchallenged when carried out under proper conditions just as we should not subscribe to "hemorrhage is a late complication and proves neglect on the part of the clinician." On the other hand, we would agree with him in the assertion that when "we recognize hyperchlorhydria and gastric neurosis as entities we will overlook fewer cases of duodenal ulcer."

Fluoroscopy of the chest will frequently reveal an enlarged aorta which suggests to this author the possibility of syphilitic duodenal ulcer or visceral lues. In his experience, the author finds duodenal ulcer rarely associated with ptosis. Dunham mentions the fact that in 2 cases with a so-called pathognomonic history they were found to be uncomplicated cholecystitis. In another case, in which the history was typical and where there was a defect in the antrum, operation revealed the presence

³⁴ Deutsch. med. Wochnschr., Berlin, July 29, 1920, No. 31, **46**, 859.

³⁵ American Journal of the Medical Sciences, vol. **160**, p. 647.

of yellowish white spots in the liver, which proved to be gummata. After this experience, a routine Wassermann was carried out in every case.

The Effects of Removal of the Suprarenals on the Automatic Contraction of the Isolated Duodenum of the Rabbit. The profound weakness which characterizes Addison's disease has often been shown to have its counterpart in the feebleness of experimental animals deprived of the suprarenals, and a number of workers have shown similar effects of suprarenal loss upon surviving striated muscle. Ferreira de Mira and Joaquin Fontes³⁶ present the results of a study of the influence of the suprarenals on smooth muscle, namely, on the duodenum of the rabbit.

Removal of both suprarenals greatly diminished, or altogether abolished, the contractions of strips of duodenal muscle from the animals killed some hours after the capsules had been removed. This enfeeblement was manifested very soon after decapsulation, in some cases within an hour and a half. It has been shown many times that the spontaneous contractions of the intestine are abolished by the action of adrenalin and by suprarenal extract. De Mira and Fontes investigated the effect of these substances on decapsulated rabbits and found that adrenalin injected into the veins of previously decapsulated rabbits depressed the automatic activity of duodenal contractions, but that after injection of fresh suprarenal extract the contractions of surviving duodenal muscle were approximately the same as the contractions in control rabbits.

The writers consider that, though they do not solve the problem, their observations tend to support Battelli's hypothesis of a protoadrenalin.

Duodenal Diverticulum with Pyloric Ulcer. Murchison³⁷ reports a case of *duodenal diverticulum with pyloric ulcer*. This case, which is supposed to be the ninth case of diverticulum of the first part of the duodenum, is interesting inasmuch as the structure of the diverticulum was that of a normal duodenum, and, furthermore, the diverticulum showed no evidence of the retention of an opaque meal. The patient died on the fifth day after operation. At operation, however, it was determined that there was an ulcer at the upper border of the pylorus while along the lower border of the duodenum just distal to the pyloric vessels there was a pouch, larger in diameter than the duodenum itself, extending directly over the surface of the duodenum. On *x-ray* examination it remained filled throughout the examination and could not be emptied by pressure over the abdomen. This patient also had a complete inverted cecum and ascending colon which is explained by an arrest in migration from the fetal position.

DISEASES OF THE PANCREAS.

New Method for Estimating Enzymatic Activities of Duodenal Contents of Normal Man. In this communication C. W. McClure, A. S. Wetmore

³⁶ Jour. de physiol. et de pathol. gen., Paris, 1921, No. 1, **19**, 1. Abstract American Institute of Medicine.

³⁷ Journal of the American Medical Association, November 13, 1920, **75**, 1329.

and Lawrence Raynolds,³⁸ considered the methods employed in studying the ferment action of the duodenal contents. The following summary is a brief practical résumé of the methods employed.

Estimation of Proteolytic Activity of Duodenal Contents. Method. The duodenal contents are centrifuged until a clear, or but slightly turbid, supernatant fluid is obtained. The latter is decanted into a clean tube. In a 50 cc volumetric flask place 1 cc of this fluid and make up the mark with 0.2 normal phosphate mixture solution of pH 8.4, and mix thoroughly.

Into test-tubes (100 x 10) place 9 cc of the casein solution. Heat in the water bath at 40° C. for five minutes. Then add 1 cc of the diluted duodenal contents, mix and incubate in the water bath for thirty minutes at 40° C. Now add 2 cc of a freshly prepared 25 per cent solution of metaphosphoric acid, mix thoroughly and filter. A perfectly clear, colorless filtrate should be obtained. One cubic centimeter of this filtrate is added to 1 cc of the digestion mixture in a Pyrex glass tube 100 x 25 mm.), a quartz pebble is added and digestion is carried out according to the micro-Kjedahl method of Folin and Wu for non-protein nitrogen in the blood. In brief, the method consists of boiling off the water and, when the white fumes of sulphuric acid begin to develop, the mouth of the tube is covered with a watch glass. Digestion is continued for from thirty to sixty seconds after the last trace of the brown color has disappeared. The tube is then allowed to cool for from sixty to seventy seconds, and from 5 to 10 cc of water are quickly added. The contents of the tube are cooled, made up to the 35 cc mark with water, and 15 cc of Nessler's solution added. The Nesslerized solution is centrifugalized to get rid of the sediment (the sediment must be pure white and not discolored by any of the precipitation of the coloring matter), and compared with standard ammonium sulphate solutions (usually containing 0.25 and 0.5 gm. nitrogen). These are prepared by placing 2 cc of the digestion mixture in a 100 cc volumetric flask, adding 5 or 10 cc of standard ammonium sulphate solution, about 60 cc of water, 30 cc of Nessler's solution and making up to the mark with water. Two controls are probably necessary for safety: (1) 1 cc of the diluted duodenal contents and 9 cc of the 0.2 normal phosphate mixture solution; and (2) 9 cc of the casein solution plus 1 cc of the phosphate mixture. In the authors' experience, neither of the controls has developed more than a trace of yellow color after digestion and Nesslerization.

Estimation of Lipolytic Activity of Duodenal Contents. Method. One cubic centimeter of the centrifugalized duodenal contents are diluted to 50 cc with the 0.33 normal phosphate mixture solution. Nine cubic centimeters of the fat emulsion phosphate mixture solution are pipetted into test tubes (100 x 10 mm.). The tubes are incubated in the water bath at 40° C. for five minutes; then 1 cc of the diluted duodenal contents is added, the tubes shaken and again incubated for one hour at 40° C. Then the contents of the tubes are at once poured into small Erlenmeyer flasks (about 150 cc capacity), the tubes rinsed with about

20 cc of 95 per cent ethyl alcohol and the rinsings added to the flasks (the ethyl alcohol has first been neutralized with tenth normal sodium hydroxide after adding phenolphthalein and titrating cold). Ten drops of a 1 per cent phenolphthalein solution are added to each flask. The degree of acidity developed, due to the formation of fatty acids, is determined by titrating with tenth normal sodium hydroxide, with the contents of the flask boiling hot. A control tube containing 9 cc of the fat emulsion phosphate mixture solution is to be used. Under the experimental conditions outlined, different samples from the same specimen of duodenal contents will develop acidities checking within 0.1 cc of tenth normal sodium hydroxide.

Estimation of Amylolytic Activity of Duodenal Contents. Method. In a 25 cc volumetric flask place 1 cc of the centrifuged duodenal contents, make up to the mark with the 0.2 normal phosphate mixture of pH 8.4 and mix thoroughly. In test-tubes (100 x 10 mm.) place 9 cc of the starch-phosphate mixture solution. Heat in the waterbath at 40° C. for five minutes. Then add 1 cc of the diluted duodenal contents, mix and incubate in the water bath at 40° C. for thirty minutes. Incubation may be carried out for a period of one hour instead of the thirty-minute period, if it is desirable to obtain a larger amount of starch digestion. In the meantime place 2 cc of the copper solution into the special blood-sugar tubes of Folin and Wu. After completion of the thirty-minute incubation period, pipette immediately 2 cc of the digested starch solution into the prepared blood-sugar tubes, rotate the contents gently and place in boiling water for six minutes. Then cool, add 2 cc of the molybdate solution, make up to the mark, mix and compare the color produced with standard glucose solutions. These are prepared as follows: Two cc of the standard glucose solution are added to 2 cc of the copper solution in the special blood-sugar tubes, boiled along with the specimens for analysis and further treated the same as these specimens. A control of 1 cc of the diluted duodenal contents and 9 cc of the starch-phosphate mixture solution should be used. Two cc being immediately pipetted into the copper sulphate mixture to stop the action of amylolytic enzyme present.

Treatment of Altered Pancreatic Function. Stepp³⁹ claims in this communication that disturbed digestion of fat has little to do with the external secretion of the pancreas or the fat-splitting enzyme. Even if the external duct is closed, steatorrhea does not exist and he claims that the deficiency in fat-splitting is due to disturbed internal secretion. Steatorrhea may be very pronounced, giving rise to greasy stools, or it may be evident only on chemical analysis. He points out that in marked derangement of fat digestion little or nothing can be done by the administration of the pancreatic gland although the administration of this same substance may be of great value when it comes to deficient tryptic activity. In milder cases, the administration of the whole gland may be of great value; the stools lose their excess of fat, the meat fibers are digested and there is a general improvement in the well-

³⁹ Therapeut. Halbmonatshefte, Berlin, August 1, 1920, No. 15, 34, 409.

being of the patient. Fresh beef or pigs pancreas can be given ground fine in the form of an emulsion or given with salt. From one-fourth to one-half of a pig or beef pancreas can be given daily. The diet should likewise be regulated, avoiding those fats which are not readily assimilated and giving an easily digestible dietary.

Pancrease. Ross⁴⁰ studied the relationship of the pancreas to hyperglycemia. This series of experiments was carried out on dogs, one group of which had complete extirpation of the pancreas and in the other group only partial extirpation was carried out. The effect of ether anesthesia was studied in both groups, and under identical conditions the increase in blood-sugar remained practically the same. If one compares the sugar output in the urine one-half hour before anesthesia and one-half hour during anesthesia there is a marked decrease in the elimination of dextrose. In other words, ether shows a tendency to produce a marked decrease in the mobilization of dextrose, and the author believes that the ether acts by producing, or rather inhibiting, the action of the internal secretion of the pancreas.

Accessory Pancreatic Tissue. Horgan⁴¹ describes 2 cases of accessory pancreas tissue. In 314 consecutive necropsies at the Mayo Clinic, 2 cases were encountered in which accessory pancreas was found. One was in a woman aged sixty-four in which a small tumor just above the papilla of Vater was found, and the other was that of a young woman, aged twenty-one years, in whom a small tumor was found in the posterior wall of the stomach near the greater curvature in the prepyloric region.

Microscopically, both of these tumors showed the structure of the pancreas, and, when properly stained, showed zymogen granules indicating that the tissue was in process of secretion. The explanation is probably an embryological one. The pancreas develops by a ventral and dorsal bud from the duodenum. The ventral arises from the junction of the common bile duct and the duodenum and soon grows around the duodenum to fuse with the dorsal bud. When the stomach and intestine rotate, the pancreas is thrown in its transverse position. The only explanation for accessory pancreas is the assumption that portions of the original anlage have been snared off in the process of growth of the gut and become imbedded in the stomach, duodenum and even in the jejunum and ileum, and mesentery. This accessory pancreas may become the seat of inflammation or chronic interstitial pancreatitis, acute pancreatitis, and even carcinoma.

Carcinoma of the Pancreas. Speed⁴² discusses the subject of carcinoma of the pancreas from the findings in 5 cases which came under his immediate attention and some of the cases occurring in the Cook County Hospital of Chicago in the last six years. In all, he has tabulated the results of 52 cases of primary pancreatic cancer. The average age was fifty-seven years, although he cites Herrington who reported

⁴⁰ American Journal of Physiology, October, 1920, No. 3, 55, 391.

⁴¹ Archives of Surgery, May, 1921, 2, 521.

⁴² American Journal of the Medical Sciences, July, 1920, 160, 1.

a case of pancreatic cancer in an infant of two years. The incidence of males to females was 5 : 1.

The most pronounced symptom, according to this author, was *cachexia*, with a weight loss of a few pounds to 80 pounds. (The reviewer has seen 8 cases of pancreatic cancer with a weight loss of from 55 to 110 pounds and considers this point an extremely important one.) As to the cause of this loss of weight, the author ascribes it to loss of fats in the stool, a marked anorexia from which most cases suffer, or possibly the inability to handle fats. Next to *cachexia*, *jaundice* was the most common symptom, being found in 80 per cent of pancreatic cancers. Pain usually of cardialgic or gastralgic character was found in 61 per cent of admission, frequently colicky and often preceding the onset of jaundice. This was explained by pressure on the common duct. A mass was felt in 55 per cent of cases, either in the liver enlarged by bile or metastases or the pancreatic tumor itself. Ascites was found in 20 per cent, hemorrhage occurred in 11 cases, constipation in 19, diarrhea in but 3 out of 52 cases. The urine of only 3 cases showed sugar. The feces showed blood in 30 per cent and free fat in 15 per cent, although the stools were frequently bulky from undigested fat and other material. In 26 cases, the gastric contents were examined and 21 showed normal or increased acidity while 5 showed a reduced amount of acid. Motor power was usually good.

An interesting point was the question of the *x-ray* examination, which was made of 23 cases, with a correct diagnosis in but 2 cases. It is mentioned that there was little to be noted except the "displaced stomach." In 2 cases which the reviewer has seen and which were correctly diagnosed, there was the roentgen ray finding, namely a defect in the antrum which was persistent and extragastric due to pressure, but in which the roentgen finding could not be substantiated by the examination of the gastric contents. In both of these cases, however, the stools were the typical white bulky stools of pancreatic disease.

Of the above cases, 11 went to autopsy, and in those cases the head of the pancreas was most frequently involved followed by the body and least frequently the tail of the pancreas. Metastases were first noted in the glands around the pancreas. Of the neighboring organs, the liver was the one most frequently involved. Ewing says that carcinoma of the pancreatic ducts follows periductal fibrosis, and carcinoma of the parenchyma appears after interstitial fibrosis. Two types of cells are found: one cylinder-celled adenocarcinoma arising from the ducts as papillary outgrowths, and second, carcinoma simplex, arising from the parenchyma usually scirrhouss in type. Speed has not found one case in the literature of successful complete pancreatectomy in cancer of the pancreas, but partial pancreatectomy can be successfully done. He also mentions the fact that palliative treatment is possible. To relieve the backing up in the gall-bladder, drainage can be performed. Patients do poorly after this operation and die after several weeks. Cholecyst-gastrostomy returns the bile to the intestinal tract as does also cholecystenterostomy.

Only 3 out of the series of 52 were successfully diagnosed. It is

interesting to note that among admission diagnoses were those of cholelithiasis, cholecystitis, carcinoma of the stomach, cirrhosis of the liver, organic heart disease, and pulmonary tuberculosis.

This paper, which is a short résumé on this subject calls attention, first, to the general characteristics of this condition; secondly, the poor results attending any operative procedure; and, third, the necessity of bearing constantly in mind the possibility of pancreatic cancer in the presence of marked cachexia and deep jaundice.

DISEASES OF THE BILIARY TRACT.

Lyon⁴³ points out the basis for the very interesting question of gall-bladder drainage. As will be recalled, Lyon's very interesting and practical communication is based on the suggestion of Meltzer that local application of a 25 per cent solution of epsom salts will relax the sphincter of the common duct and permit the ejection of bile. On the basis of this suggestion the author has attempted to outline a practical method of the fractional separation of the bile from the various portions of the biliary apparatus. We would point out that this author very wisely states that he does not mean to infer that the segregation of bile can be made so sharply as to positively state that it comes unquestionably from the bile ducts or from the gall-bladder or liver, but that such a method offers the possibility of saying that the larger amount of bile recovered from duodenal intubation is being drained from either the ducts, the gall-bladder, or the liver. We believe that this latter assertion, while not definitely proven, is nevertheless of sufficient importance to warrant its inclusion in the routine study of gall-bladder disease.

The first bile which is collected after the injection of epsom salts may be somewhat diluted with the epsom salt solution. Shortly after that, however, a rather pure yellow bile comes directly from the ducts. In a short space of time the bile deepens, becomes darker in color and more viscid, and this is presumably gall-bladder bile. After a period of time the bile becomes a limpid, transparent, yellow, distinctly thinner and obviously coming from the liver.

The author believes that the dark colored bile is gall-bladder bile, first because it coincides with exactly what one would expect according to the law of Meltzer; second, because from its color and its viscosity, it appears to be a highly concentrated bile which could only come from the gall-bladder. The cytology of the sample also suggests its derivation from that region, and, furthermore, its pathological characteristics are more pronounced when gall-bladder disease is present. The author further mentions the fact that nearly 6 ounces of darker bile must be accounted for as coming from some place between the common duct sphincter and the secreting cells of the liver, a quantity of bile which could not be contained in the ducts alone. He has never been able to obtain the dark bile in individuals who have had a removal of the gall-bladder.

⁴³ American Journal of the Medical Sciences, October, 1920, 160, 515.

In this article the author develops thoroughly the entire question regarding gall-bladder drainage, and we believe that there is no question but that it is possible to determine or rather to obtain bile which is predominately gall-bladder or predominately hepatic bile. We do not believe, however, that it is possible by this method or any other method to obtain an absolutely pure sample of bile from the duodenum. In a series of investigations performed in our laboratories, it was always possible to demonstrate ferment action in the bile no matter what fractional sample be obtained. The essential considerations regarding the study of the bile from the pathological standpoint are practically the same as they always were, pus, epithelial desquamation have their significance as they do in any other fluid in the blood, but it is to Lyon's credit that this method will at least enable us to predict from whence it comes. It emphasizes the necessity for examining more than one sample of the bile.

The reviewer has performed many thousands of biliary taps in the last six years, and he does not believe that magnesium sulphate alone is the only substance which can bring about this phenomenon. In fact, in duodenal intubation without epsom salts it is possible to obtain bile partitions which are very different in nature, and to which varying derivations can be assigned. An increased leukocyte content, cholesterol crystals, undue epithelial desquamation of the tract have all been recognized previous to this period as evidence of gall-bladder and gall-duct diseases, but the idea of the essential attempt to locate the source of trouble and its entire practicability of which we have been many times convinced makes us believe that this is of very great value in the study of these cases. We have, over the last six years, by biliary drainage and direct treatment to the duodenum through the tube without the introduction of epsom salts succeeded in producing very marked improvement and we feel that this method is certainly worthy of careful consideration.

Sachs⁴⁴ considers the question of biliary drainage and comes to the following conclusions: First of all, let us consider its diagnostic value.

1. It gives us definite information as to the patency of the ducts. If A, B and C biles are found, we can be reasonably sure there is no great obstruction to the ducts. If, on several drainages, no B bile is found, an obstruction at, in or around, the cystic duct may be found.

2. Macroscopic blood, and no bile on stimulation with magnesium sulphate, in conjunction with other physical signs, aids us in the diagnosis of malignancy.

3. Real dark B bile means biliary stasis. Enteroptosis can be placed under this heading.

4. Dark bile, with positive cultures, aids in the diagnosis of the type and location of our infection.

5. Gall-bladder sand may aid in the diagnosis of stones.

6. In cholecystectomy with recurrent symptoms, we can determine as to the patency of the ducts, and whether or not infection is still present.

⁴⁴ Nebraska State Medical Journal, August, 1921, p. 225.

7. It is another means of locating foci of infection.
 8. It aids in the diagnosis of typhoid carriers.
 9. It can be used as an aid in the diagnosis of pancreatitis.
 10. According to Palefski, it is an aid in visualization of the duodenum.
- A distorted duodenal curve denoting evidence of periduodenal adhesions.
11. It aids in diagnosis of certain types of headaches.
 12. It assists in diagnosis of all lesions producing pain in the right upper quadrant. *Secondly*, let us consider its therapeutic value:
1. It is an excellent aid for cholecystectomized patients with return symptoms.
 2. It is also an aid for hepatic drainage after operation before return symptoms.
 3. It benefits most cases of biliary stasis, if no obstruction to the ducts are found.
 4. It may be used in all conditions where surgery is contraindicated—
(a) old people, (b) heart cases, (c) diabetics, etc.
 5. It may aid in clearing up typhoid carriers.
 6. It hastens convalescence of catarrhal jaundice.
 7. It aids some cases of stasis in pernicious anemia, hemolytic icterus, etc.
 8. It benefits enteroptotics with pain in the right upper quadrant.
 9. It may be used to obtain autogenous vaccines in foci found in the biliary tract.
 10. It is of value as pre- and post-operative treatment in gall-bladder surgery.
 11. It benefits so-called biliousness, migraine, lethargy, etc.
 12. It is an aid in the treatment of pancreatitis.

Physiological Causes for the Varied Character of Stasis Bile. Peyton Rous and Philip D. McMaster,⁴⁵ find that the gall-bladder and ducts exert opposite influence upon the bile. The ducts fail to concentrate and thicken it with mucus as the bladder does, but dilute it slightly with a thin secretion of their own that is colorless and devoid of cholates, even when the organism is heavily jaundiced. The fluid may readily be collected into a rubber bag connected with an isolated duct segment. It continues to be formed against a considerable pressure, and, in the dog, is slightly alkaline to litmus, clear, almost watery, practically devoid of cholesterol, and of low specific gravity to judge from the one specimen tested.

In obstructed ducts separated from the gall-bladder or connecting with one so changed pathologically that the concentrating faculty has been lost, such fluid gradually replaces the small amount of bile originally pent up. It is the so-called "white bile" of surgeons.

When obstructed ducts connect with an approximately normal gall-bladder, the stasis fluid is entirely different, owing to the bladder activity. At first, there accumulates in quantity a true bile much inspissated by loss of fluid through the bladder wall, darkened by a

⁴⁵ Journal of Experimental Medicine, July 1, 1921, **34**, 75.

change in the pigment, and progressively thickened with bladder mucus. As time passes, duct secretion mingles with the tarry accumulation and very gradually replaces it. The inspissation of the bile, as indicated by the pigment content, is at its greatest after only a day or two of stasis. The differing influences of the ducts and bladder upon the bile must obviously have much to do with the site of origin of calculi and their clinical consequences. The concentrating activity of the bladder cannot but be a potent element in the formation of stones. This is discussed. Intermittent biliary stasis is admittedly the principal predisposing cause of cholelithiasis; and the stasis is to be thought of as effective, in many instances at least, through the excessive biliary inspissation for which it gives opportunity. In this way a normal gall-bladder can become, merely through functional inactivity, a menace to the organism. In patients with the tendency to stones, frequent feedings may lessen the danger of their formation.

Diagnosis of Gall-bladder Disease. Cheney,⁴⁶ in this discussion covers the summary of the various investigations which are carried out in the study of these conditions. They might be enumerated as the history, physical examination, laboratory and roentgenological investigations.

In the study of the history of these cases, they may be divided into four groups: Group I. Recurring attacks of colic with good health between attacks. Group II. Recurring attack of colic with more or less indigestion between. Group III. Chronic stomach trouble with subacute gall-bladder attacks. Group IV. Chronic stomach trouble with no history whatever pointing to gall-bladder attacks.

In the consideration of Group I, the history of colic is usually so characteristic as to suggest no other diagnosis than that of gall-bladder disease. The pain comes and ends very suddenly, radiates in characteristic fashion, shows no relationship to food, and is colicky and griping in character. Variations in the intensity and radiation of this pain may naturally exist, such as a form of pain shooting right through the back, or to the right side rather than to the left, creating a suspicion of heart disease or even angina. Again, it may radiate down on the right side in the direction of the appendix and give rise to the suspicion of appendicitis. Jaundice as a sequel to the severe type of pain practically certifies the diagnosis. In the second group, the indigestion may overshadow the acute attacks and may either be of the ulcer type, with burning or regurgitation at definite time phases after food ingestion, or, on the other hand, it may be, as is much more frequently the case, the type of symptomatology encountered in the gastritis group with hypochrardia. This group is characterized with distress and fulness after eating, and persistent gas formation.

In Group III, the indigestion takes up the greater part of the picture, punctuated with spells of biliousness rather than attacks of colic. There is frequently reference to the right side and under the ribs, but rarely exact localization and rarely the clean-cut picture of typical biliary colic. Group IV shows irregular forms of chronic indigestion, some of them

⁴⁶ American Journal of the Medical Sciences, October, 1920, 160, 469.

of the gastric ulcer type, some of the chronic gastritis type, others in which the nature of the case suggests the possibility of gastric carcinoma. There are no attacks of biliary colic to direct attention to the gall-bladder, although sooner or later in many of this group a sudden attack, such as characterizes Group I, will settle the diagnosis. Thus in Group I biliary colic dominates the picture, in Group II the stomach symptoms play a prominent part, but the colic still features the case, in Group III the gastric symptoms predominate, colic has disappeared and biliary symptoms have assumed a minor importance, and in Group IV, there are no symptoms but those produced by the stomach. There should be, according to this author, a fifth group in which a gall-bladder with stones exists, but in which no symptom of any kind occurs.

In the study of physical examination, he divides the findings as follows: (1) Negative findings; (2) evidence which is purely subjective; (3) definitely objective as well as subjective evidence. The first group shows no evidence on palpation, and this may be true of a diseased gall-bladder which is quiescent, even though it may reflexly cause constant gastric distress. In the second group are those cases in which the patient feels tenderness but in which the examiner is not conscious of any abnormality by palpation alone. In Group III, there may be increased tension and rigidity, and even a palpable tumor. The latter may mean nothing more than adhesions around the organ and possibly stones in the bladder, but usually it means either an obstruction of the cystic duct, with retention of bile, or else neoplasm.

In the consideration of the laboratory examination, but little emphasis is placed by this author on these procedures, probably owing to the fact that not as much stress was laid on these methods when these cases were studied. Regarding the direct examination of the bile by duodenal intubation, his results have not been satisfactory, the objections being concerned with the practicability of the method and not its value; but according to the author, this value has not been found so great as to offset the obstacles offered in securing duodenal contents and in getting them properly examined chemically, microscopically and cytologically. As now performed, however, these studies can readily be carried out, and in the reviewer's opinion no case of this type is completely studied until these results are recorded. In the study of gall-bladder disease, the gastric contents were examined in the usual way in 81 cases. The total acidity was under 40 in 26 cases, and under 20, with a complete absence of free HCl, in 12 cases; the total acidity was over 60 in 38 cases; and the other 17 were within normal limits. The statement is made, however, that hypoacidity, and particularly achylia, is found with gall-bladder disease more often than with any pathology excepting cancer. In the *x-ray* study of this region, we find direct evidence of stone or of the enlarged organ in probably not more than one-quarter; on the other hand, we may have evidence of an indirect nature, such as deformity of the duodenal cap from adhesions and pressure, pulling of the stomach to the right, and fixation of the hepatic flexure of the colon, all of them induced by gall-bladder pathology. Finally, the *x-ray* demonstration of a normal stomach, duodenum, small bowel, appendix,

and colon may be of great value in finally determining the seat of an upper abdominal pathology as located in the gall-bladder.

In the summary, this author considers history of the greatest value, and physical examination next.

Gall-stones. Friedenwald and Ullman⁴⁷ discuss the instance of gall-stones in the young. They report 5 cases with ages varying from fifteen to eighteen years, and, as in older individuals, the condition is more frequently found among females than males. The clinical picture is the same as in the adult. While no causative factor was found, nevertheless it is remarked that jaundice occurred in 3 cases out of the 5.

Cyst of the Common Bile Duct. A cyst of the common bile duct is a rare condition and only 35 cases have been reported. In no instance has the diagnosis ever been made before operation. In McConnell's⁴⁸ case the cyst was a large one extending from the extreme right of the abdomen to a point to the left of the midline. It was operated on and a year later again opened up, at which time a large quantity of pus mixed with bile was evacuated. A third operation showed that it had shrunk to the size of a walnut. The patient made an uneventful recovery.

Blood Cholesterol in Gastro-enterologic Cases. Schnabel⁴⁹ discusses the question of the blood cholesterol in various conditions involving the digestive tract. The blood cholesterol in health follows fairly constant levels and is both endogenous and exogenous in origin. This author claims, however, that the origin of blood cholesterol is for the most part exogenous. Some time ago the reviewer, with Hawk and Lichtenthaler, went over this question thoroughly, and there was evidence to indicate clearly the origin from both sources. The author states that blood cholesterol can be readily increased by feeding substances rich in cholesterol, but "that the biliary cholesterol can be increased in this way seems uncertain." We recall from the literature several classic studies which demonstrated the association of blood and biliary cholesterol. The fact remains, however, that studies of the type which Schnabel has performed are of great value in associating the facts of the case. While the normal variations range between 150 and 200 mgm per 100 cc, the figure for cholelithiasis was high, 228 mgm; while other cases averaged 207 mgm.

Jacobson⁵⁰ discusses in a general way the subject of gall-bladder disease. As he points out, gall-bladder disease, *viz.*, both the inflammation of the gall-bladder and gall-stones, is essentially a disease of middle age occurring with special frequency in women and closely associated with the question of pregnancy. Gall-stones are in all probability due to the hematogenous infection, probably streptococcal, of the gall-bladder and bile passages and associated with an altered cholesterol content of the blood. He believes that cholecystectomy is the operation of choice. Medical treatment of chronic cholecystitis and the methods which we

⁴⁷ Southern Medical Journal, October, 1920, No. 10, 13, 700.

⁴⁸ British Journal of Surgery, Bristol, April, 1920, 728, 520.

⁴⁹ American Journal of the Medical Sciences, vol. 160, p. 423.

⁵⁰ Archives of Surgery, September, 1920, No. 2, 1, 310.

use for chronic inflammations of the gall-bladder at the present day can be grouped in three classes, *viz.*, dietetic, vaccine therapy, and duodenal tube therapy.

Minet⁵¹ mentions the medical treatment with hexamethylenamine. He gives it in the vein in a series of 5 daily doses of .5 to 1 gram; in a second series from .25 to .75 grams, and in the third series up to 2 grams. The total was therefore 21.25 grams in fifteen days, given in a .25 gram per cc as well as in distilled water. The clinical cure of this case was complete.

Jaundice from Late Salvarsan Poisoning. John Elliott⁵² describes a case of jaundice which he believes is due to late salvarsan poisoning. The history of this case is appended because it emphasizes not only the method of treatment used, but also the fact that there seems to be some question as to the cause of jaundice. This author is of the opinion that this was a case of late jaundice due to salvarsan poisoning. The interval between the last injection and the onset of symptoms was about forty-two days, and while it is true that this individual showed an unquestioned series of toxic effects from the injection of salvarsan, yet we believe that this case is still open to question. There are so many toxic infectious causes for jaundice that the unquestioned assumption of this explanation does not appear to us to be warranted.

This author claims that one of the most efficient and simple diuretics is whey, and, when used during salvarsan and mercury treatment, is of considerable benefit. This is a suggestion which, together with a suggestion regarding the use of adrenalin and calcium, could well be embodied in our treatment of syphilis. Furthermore, this author gives all patients undergoing a course of salvarsan and mercury a teaspoonful of sublimed sulphur in syrup at bedtime to assist in the elimination of mercury and also indirectly of the organic arsenic compound.

On January 22, of this year, a patient attended the clinic with the following history:

A man, aged thirty-nine years, employed on a farm, had rheumatic fever in 1913; he was laid up for twelve weeks. He joined the army in February, 1918; served in the R. E. in Kent; never abroad. He had a venereal sore when he joined the army, a slight rash on the arms, no sore-throat, and had had no treatment.

In 1919, the glands in the neck were enlarged, and he was discharged from the army on this account. From May to September, 1919, he was in the Chester Royal Infirmary. Lymphadenoma diagnosed; treated with arsenic and α -rays; no improvement. July 21, 1919, Wassermann test positive; treatment, potassium iodide and mercury ointment inunction; lost sight of until March, 1920, when he appeared at the venereal clinic. March 20, 0.45 gm. novarsenobillon intravenously, inunction; March 27, not well, injection omitted; April 3, 0.45 gm., April 10, omitted; April 17, 0.6 gm., April 24, 06 gm., May 8, 06 gm., not well after the injections; these omitted until June 5, 0.45 gm.; June 12, 0.45 gm.; injections discontinued again; June 24, Wassermann

⁵¹ Bull. de la soc. med. des hôpitaux, Paris, July 9, 1920, No. 25, 44, 1002

⁵² Lancet, June 4, 1921, p. 1180.

positive + +; July 28, 0.45 gm.; August 4, 0.45 gm., August 11, 0.06 gm. and hyd. 1 gr. intramuscularly; August 18, 0.6 gm.; September 1, 0.6 gm. and hyd. 1 gr., September 8, 0.6 gm. hyd. 1 gr., September 25, 0.6 gm. and hyd. 1 gr.; October 2, 0.6 gm., hyd 1 gr., October 9, not well; October 16, 0.6 gm., October 23, Wassermann positive + +; November 20, 0.45 gm., hyd 1 gr., November 27, 0.6 gm., hyd. 1 gr. Continued to attend at the clinic, but felt unwell.

He always felt ill after the injections; shivering, giddiness, sometimes sickness, feeling of prostration and distaste for food. The specific treatment was entirely discontinued and tonics were administered from time to time. It is noteworthy that intramuscular injections had the same effect as those given intravenously.

January 22, 1921: He came to the clinic complaining that he had been vomiting after everything he had ingested, and noticed that he was yellow. Pain coming and going in the stomach; the urine had been a deep color. He was at once admitted as an in-patient; put on low, fat-free diet; sulphur, a teaspoonful at bedtime, and barley water freely. He did not vomit during the first two days in the hospital. January 24, 4.30 P.M., one pint of normal saline given intravenously; 6 P.M., hematemesis, about 5 oz. bright blood vomited; diarrhea; severe pain in epigastrium and under right ribs, shooting to back and up right side. Temperature 103.4° F., pulse 128; 9 P.M., I saw him at the infirmary; he was deeply jaundiced, pulse 140, collapsed and feeling very ill; right upper rectus abdominis rigid; tenderness in epigastrium and over gall-bladder region. Gall-bladder could be felt distended; spleen not felt; liver dulness normal. I formed the opinion that the gall-bladder was distended with blood. Ordered liquid adrenalin chloride m. 25, and calcii chloride, 10 gr., in alternate doses four times a day.

January 25, much better, no further vomiting or diarrhea; pain not so severe; 20 oz. of dark-colored urine had been passed during the preceeding twenty-four hours. Feces clay-colored.

January 26, 10 oz. normal saline, given intravenously; slight shiver followed and temperature rose to 99°. Gall-bladder diminished in size, liver and spleen normal, less pain. (The distilled water used in preparation of the normal saline was not above suspicion, so I had it doubly distilled, and no further ill-effects followed the injections.) Saline administered *per rectum* in addition to the intravenous.

January 27, 10 oz. saline intravenously; the same quantity per rectum; amount of urine increasing; 40 oz. passed. Herpes on upper lip; pain still off and on. January 28, saline as before, pulse 62. Jaundice unaltered; patient felt drowsy. Gall-bladder still palpable; urine gave iodine reaction for bile pigment for first time. No albumin at any time; urine 30 oz.; no leucin or tyrosin. January 29, vomited; no blood. Still drowsy; jaundice decreasing. On the 30th all treatment was intermittent for one day; on the 31st saline (one pint) was given intravenously; half pint per rectum, followed by increased excretion of urine: 40, 57, 45 oz. on succeeding days.

Adrenalin and calcium stopped on February 1. Jaundice gradually disappeared, drowsiness diminished, urine and feces became normal,

and patient completely recovered. Nothing could be felt of the liver, gall-bladder, or spleen. I may mention that the enlarged glands in the neck, which had begun to decrease in 1919, had disappeared when he returned to the clinic in 1920. Wassermann test, March 22, 1921, positive + +. I was somewhat disappointed to find that the severe experience through which he had passed had left the blood reaction unaltered. In the face of such a marked positive reaction as this, it would be wrong entirely to discontinue active specific treatment, and I propose to order thorough treatment by inunction of mercury, combined with the dose of sulphur each day, send him into the country for a month to reëstablish his general health, and then admit him to a hospital for a complete course of salvarsan and mercury treatment under observation, guarded by the adrenalin and calcium dosage as in the case of tabes recorded above. Under these circumstances it will be possible to keep under observation the effect of the injections and the efficient working of the kidneys.

Hypertrophy of the Liver, Toxic in Type and Apparently of Gastro-intestinal Origin. In 1920, Bittorf and van Falkenhausen⁵³ observed 10 cases of a form of liver infection, dependent probably on the post-war conditions which obtained at that time. The liver was found to be slightly enlarged, and the gastric analyses showed a distinct decrease of acids, and the functional liver tests showed levulosuria after the ingestion of 50 grams of levulose. These authors believe that the condition is due to gastro-intestinal disorders incident to the lack of food, and partly by the morbid disintegration of foodstuffs. On a high calorie diet and the administration of pepsin and hydrochloric acid, 3 of these cases were cured in three weeks. This is an interesting question, namely, in how far gastro-intestinal conditions are responsible for hepatitis, and, secondly, the possibility of hepatitis incident to gastro-enteritis as a condition far more frequent than is commonly supposed.

Homans⁵⁴ gives the following reports on 223 cases of cholecystectomy. Twelve died in consequence of the operation. Of the remaining 212, only 165 cases could be traced, and, of these, 127, or 77 per cent., of the cases can be considered well so far as the biliary tract is concerned. Homans believes that the dilatation of the biliary passages follows this operation and there is no evidence to his knowledge that such dilatation is harmless.

Jaundice. Charles Mayo⁵⁵ describes the operative statistics regarding the treatment of gall-stones. Jaundice, in this observer's opinion, is usually a late symptom, and usually indicates a neglect to recognize the condition in the truly preventative period. The mortality following cholecystectomy in the treatment of cholecystitis was only 1.8 per cent in 2460 operations performed during a three-year period. In 337 cases in which cholecystectomy and choledochotomy were both done, the mortality was 3.2 per cent. In 36 cases of malignant obstruction, the mortality was 16.6 per cent. Stones were found in the common duct in 274 out of 420 cases.

⁵³ Deutsch. Arch. f. klin. Med., Leipsic, March 8, 1921, **135**, 346.

⁵⁴ Boston Medical and Surgical Journal, September 2, 1920, No. 10, **183**, 282.

⁵⁵ Surgery, Gynecology and Obstetrics, Chicago, June, 1920, No. 6, **30**.

HEMOLYTIC JAUNDICE. Lenas discusses the results of his studies of hemolytic jaundice in 2 women with their 5 children, and 1 man and his son. In this study the point which he noticed was the discordance between the number of nucleated corpuscles and such as is seen in the severe anemias compared with the lack of a sufficient anemia to justify it. In other words, it is pointed out that this particular discordance between the blood picture and the degree of anemia occurs only in hemolytic jaundice. The presence of megaloblasts with normal-blasts, and at the same time without enough anemia in the blood to explain their presence, according to this author would indicate the presence of megaloblast tissue which should disappear or undergo involution when the normalblast tissue develops to take its place. This form of involution is usually completed after birth, but it may be arrested in this disease. Certainly there is something to hemolytic jaundice which suggests that there might have been a delay or a retardation in the evolution of certain parts of the blood-forming organs.

Kaznelson⁵⁶ reports 2 cases which would sustain the belief that the spleen produces bilirubin out of the destroyed red blood coloring material, so that one would gain the idea that the liver was not necessarily diseased in this condition. In the first place, the removal of the spleen puts an end to the condition. It is interesting to note that Van den Bergh reported finding more bilirubin in the blood from the splenic vein than from the peripheral veins. In discussing the question of urobilin, it will be recalled that this substance is supposed to be derived from the bile pigment through the action of bacterial agencies. It has generally been considered, therefore, that this substance was formed in the intestine. From there it may be excreted, or absorbed and carried to the liver and eliminated through the kidneys. This means, therefore, that unless bile pigments are reaching the intestine, urobilin will not be found in the urine, and, in fact, it is well known that urobilin is absent in the urine in a complete obstruction of the common bile duct. On the other hand, another theory has been held, *viz.*, that urobilin in the urine might be interpreted as evidence of defective liver cells which are unable to remove it from the portal blood.

In an editorial in the *Journal of the American Medical Association*, October 9, 1920, vol. 75, p. 1007, attention is called to the experiments of Whipple, Hooper and Robscheit in which the assertion is made that there is no conclusive proof that urobilin is ever absorbed in the intestines. They found, for instance, the constant presence of urobilin in the bile of fasting dogs with biliary fistula. They state that at times the bile pigments may be almost completely replaced by the urobilin. They believed, on the contrary, that the urobilin might be contributed to the production in part from the bile pigments in the bile ducts as the result of bacterial activity. This is simply suggested as another type of interpretation of this well-known condition.

⁵⁶ Wien. Arch. f. inn. med., August 1, 1920, No. 3, 1, 563.

DISEASES OF THE INTESTINES.

Studies of the Anatomy of the Muscular Action of the Small Intestine. Carey⁵⁷ has, in a rather ingenious way, studied the architectonics of the small intestines. He points out the fact that instead of the inner and outer mucus coats of the small intestine being arranged as a tube composed of different muscular rings with a certain degree of communication, the arrangement is entirely different. Such a conception, he says, is an anatomical heirloom, and, due to its apparent truth by a mere cursory microscopical examination, is accepted by the present generation as an assimilated fact. This contribution is one of very considerable interest and points out the following facts:

That the inner muscular coat of the small bowel is not composed of circular or annular rings, but is a continuous muscular sheet wound into a close helix. In other words, this inner coat represents a closely wound internal spiral, making one complete turn in every millimeter or less. Furthermore, the muscular coat of the small intestine is not composed of longitudinal fibers parallel to the long axis of the bowel, but is composed of elongated fibers set at an acute angle to the long axis of the bowel so that this coat likewise pursues a spiral course while this spiro character is obliterated in many places due to the torsion of the bowel. Nevertheless, these fibers make a complete turn every 200 to 500 mm. Another interesting point is the fact that the submucosa is composed of connective tissue fibers forming an inner closed, and an outer open, spiral. The inner spiral makes a complete turn in every millimeter or less, and the outer makes one in every 4 to 10 mm. Another observation is the fact that the valvular connivens of the duodenum are arranged as interdigitating spirals.

In conclusion, it may be of interest to cite *verbatim* the deductions regarding the muscular action of the small bowel as cited by the author. There is nothing which is of more importance at the present time than an accurate knowledge regarding the complex mechanism of intestinal peristalsis.

“Muscular Action in the Small Intestine.”

“1. Because of the left-handed, helicoidal arrangement of the musculature of the intestines, the intestinal movements are comparable to the action of a left-handed screw.

“2. The fasciculi of the inner coat make one complete turn in every 0.5 to 1.0 mm., whereas those of the outer make one complete turn in every 200 to 500 mm. Consequently, if we consider the fasciculi as not interconnecting, which they are, however, we will find that a contraction wave that travels 5 mm. in a linear direction through the inner coiled muscle coat will find its complementary contraction wave, that started at the same time and place in the outer coat, to have traveled approximately 300 mm. in a translatory direction. This estimate is based on an intestine 25 mm. in diameter.

“3. The inner muscular layer is wound as a closed spiral. The outer

as an open spiral. The difference in rate of translatory progression of the two contraction waves depends upon this muscular arrangement. The wave, traveling in the inner group of fibers takes a rotary course, whereas that in the outer fibers takes a more translatory course to reach a corresponding destination. Therefore the contraction of the stronger inner muscle coat will inevitably trail that of the outer. The arrangement of the intestinal muscular layers clearly explains the phenomenon of cephalic constriction and caudal dilatation of diastasis without invoking the aid of hypothetical nerve paths. Peristalsis, therefore, is a duplex contraction phenomenon produced by the differential rate of translatory advance of the two contraction waves in the outer and inner muscle layers, respectively.

"4. By exsection of the inner muscular layer of the intestine, it is proved that the caudal dilatation of diastasis is produced primarily by the summation of contractions in the outer layer of muscle fibers.

"5. By exsection of the outer muscular layer, it is proved that the cephalic constriction is caused by the inner layer of close spiral fibers.

"6. The movement of the intestine depends upon the reciprocal elongating actions of the outer and inner layers of muscle fibers, respectively. These movements are superimposed on the tonic condition of equilibrium of the two muscle layers. The application of any drugs, therefore, that decrease the excitability of the musculature or destroy the tonic equilibrium of the two layers will indirectly affect the typical muscular responses."

Acute Infectious Enteritis with a Polyneuritic Syndrome. Farnell and Harrington⁵⁸ presents an interesting series of cases of infectious origin which occurred in the latter part of July, 1917, in which acute gastro-intestinal symptoms were associated with an accompanying involvement of the nervous system. There were 47 cases, and 4 employees who were quarantined, and some 20 other individuals had symptoms so mild that they were only regarded as suspicious cases. It is possible that they may have been mild or abortive cases of the disease.

The general onset of clinical symptoms, according to these authors, were acute gastro-intestinal disturbances, characterized by nausea and vomiting, frequent bowel discharge containing mucus, and in some cases both mucus and blood; with a rise in temperature to 100° and in some cases to as high as 104°. In many cases there was prostration with headache and backache. The neuritic symptoms were those of what appeared to be a peripheral neuritis, involving either the upper or lower extremities and in a number of cases both extremities. In some cases there was excessive pain on slight pressure over the involved extremities, and in others only pain on deep pressure. The reflexes generally were absent on both sides, but in a few cases only on one side. There was also great weakness on walking and coördinating. Some could stand only with help but could not walk.

In a few cases, there was complete paralysis of the lower motor neuron of both the upper and lower extremities.

The early cases were the most severe and showed the slowest improve-

⁵⁸ American Journal of the Medical Sciences, July, 1920, 160, 52.

ment. These authors divided the cases into three groups, the first in which the gastro-intestinal symptoms predominated, and in which the neuritic symptom was also prominent; the second, in which the gastro-intestinal symptoms were most prominent, but in which the neuritic symptoms were less pronounced; and the third in which there was little or no evidence of a peripheral neuritis.

Bacteriological studies of these cases seemed to show that the source of infection was milk; that the agent was the staphylococcus of a particularly virulent *auteus* type; that the mode of entrance was the gastro-intestinal tract; as manifested by the symptoms, vomiting, marked gastric distress and pain, with profuse bloody diarrhea. During this stage there was a concomitant rise in temperature, and in some cases acute delirium and excitement lasting over several hours. Blood analysis revealed the presence of a staphylococcus bacteremia, in other words an hematogenous infection. The authors explain the neuritis on the basis of a selective action upon the peripheral nervous system causing the symptom-complex known as peripheral polyneuritis, while pathologically, from autopsy findings, hemorrhagic neuritis was noted.

Intestinal Tuberculosis. Caird⁵⁹ reports the result of his studies on intestinal tuberculosis in some 43 cases. Eleven of which have been previously reported. He recognizes two types of this disease—one which is acute and destructive, most frequently encountered with pulmonary tuberculosis. This form is due to the direct swallowing of infected sputum, and, as Conradt points out, this form of infection may occur through the ingestion of infected food, particularly milk; or by the swallowing of infected sputum, and, finally, by the blood stream. This type develops severe intestinal ulceration associated with diarrhea, and in most cases follows a very rapid course. Statistics are quoted regarding the frequency of this form of intestinal tuberculosis.

The second type of the disease is essentially chronic and plastic. It may occur with little or no evidence of pulmonary disease, and is produced usually by an infection through the blood stream or through lymphatic channels. It is this form which induces hyperplastic strictures and deformities of the bowel. The treatment of this type is essentially surgical.

It is the second, the hyperplastic or hypertrophic type, which calls for special attention. It seems to be widely distributed throughout the civilized world. Cases are reported from Great Britain, Scandinavia, France, Germany, Middle Europe, Russia, Italy, Japan and North America, as well as Turkey, Portugal, and South America.

According to Caird, the age and sex of the patients are as follows:

Age in years.	Male.	Female.	Total.
1 to 10	1	1	2
11 to 20	5	3	8
21 to 30	3	9	12
31 to 40	3	10	13
41 to 50	1	3	4
51 to 60	0	1	1
60 to 70	3	0	3
Totals	16	27	43

⁵⁹ Edinburgh Medical Journal, February, 1921.

The chief site of the lesion is found at the ileocecal region, a part predisposed to inflammation from anatomical and physiological reasons. The appendix and lymphatic glands of the ileocecal angle may play a leading role.

In the first, or destructive type, the general virulence of the ulceration may quickly carry off the patient, without producing perforation of the gut. Occasionally, a fistula may follow. This may occur in both forms, but in the second type, which is distinguished by such a great proliferation of connective tissue, perforation into the free peritoneal space is rendered well-nigh impossible. The destructive advance becomes checked by changes which recall the fibromatosis seen in some cases of pyloric ulcer and carcinoma, or again in keloid. It is this extraordinary hypertrophy which constitutes the leading danger, that of stenosis from the associated longitudinal and circular contraction of the new fibrous tissue.

This process seems to be one in which comparatively mild virulence of the organism is associated with an exaggerated connective tissue overgrowth.

In these cases the diagnosis was by no means always apparent, and the disease resembled both malignancy and, also at times, subacute appendicitis. It is interesting to note in this connection that an inquiry into tuberculosis, so far as family history was concerned, revealed the presence of this condition in 18 instances. In 1 case microscopical investigation revealed the presence of both tuberculosis and carcinoma.

The treatment of the hyperplastic type is surgical, and involves the same principles as those employed in malignant diseases of the bowel—namely—the excision of the affected area, reserving the operation of short circuiting only when the other method is impractical. The end-results are more hopeful than those in cancer, and the following tables will give some idea of the results obtained with these cases.

	Cases.	Operative results.		
		Operation.	Recovered.	Died.
Died in hospital . . .	13	Resection	1	27 12
Died at home	13	Resection	2	2
Alive recently	14	Short circuiting . . .	1	3 1
Not traced	3	Short circuiting, etc. .	2	3
	43			35 13

DIED AT HOME.

- 5 within 6 months; 3 of tubercle; 2 of other or unknown cause.
- 4 within 12 months; 3 of tubercle; 1 of other or unknown cause.
- 2 within 2 years; 1 of tubercle; 1 of other or unknown cause.
- 1 within 5 years; 0 of tubercle; 1 of other or unknown cause.
- 1 within 12 years; 1 of tubercle; 0 of other or unknown cause.

ALIVE WHEN LAST HEARD OF.

5 after 2 years	2 after 14 years
1 after 4 years	1 after 15 years
2 after 5 years	1 after 15 years
2 after 11 years	

Diverticula of Small Intestine, other than Meckel's Diverticulum. In 1847 complete barium meal studies, Case,⁶⁰ and his associates, showed the presence of diverticula in the duodenum in 85 cases, diverticula of the jejunum in 4 cases, and diverticula of the jejunum and ileum in 1 case. The statistics of this author are sufficiently interesting to quote in detail, and it is a matter of interest to note that this is the most complete series of cases yet reported in which it was possible to diagnose these conditions before operation.

DIVERTICULA OF THE DUODENUM. "Frequency. Necropsy reports quoted by Baldwin, Buschi, Davis, Wilkie, Fischer, and others, give varying figures as to the frequency of duodenal diverticula in man. One author claims as high a figure as 11 per cent of all such sacculations of the alimentary tract. Linsmayer found 45 cases of duodenal sacculation in 1,367 necropsies (about 3 per cent). Rosenthal found 3 cases in 100 necropsies (3 per cent). The Johns Hopkins Hospital statistics on 2600 necropsies record 13 diverticula other than Meckel's in the small intestine and 18 in the colon. In Case's series of 6847 consecutive barium meal studies, duodenal diverticula were found in 85 cases (1.2 per cent, or in the proportion of 1 to 82. For comparison, it may be interesting to know that in the same series Case found colonic diverticula in 138 cases, or approximately 2 per cent.

In Baldwin's Cornell series there were two diverticula in 1 case, the other 13 being single. Buschi found 35 cases with a single diverticulum, 13 with two, 2 with four, and 2 with five. In this series only one diverticulum was recognized in 78 cases, the other 7 cases showing from two to four diverticula.

"Size. The diverticula vary in size from a pea to a hen's egg. Baldwin's largest diverticulum measured 5 cm. in diameter. In Case's series of 85 cases, the shadow of the barium-filled diverticulum measured more than 4 cm. in 14 cases, and in 1 of our 10 operative cases the excised diverticular sac measured 5 cm. in longest diameter. The average size of the sacculations in this series was 2.8 cm.

"Position. In Baldwin's Cornell series the sac originated in the first part of the duodenum in 2 cases, in the second portion in 7 cases, and in the third portion in 6 cases. In Case's series the diverticula were thus distributed: First portion, 17 cases; second portion (including those cases thought to be dilatations of the diverticulum of Vater) 49 cases; third portion and duodeno-jejunal junction, 19 cases.

"Sex. In 61 necropsy cases, reported in the literature, where the sex was known, 38 (62 per cent) were in males, 23 (38 per cent in females). In the present roentgen-ray series of 85 cases, 34 (40 per cent) were in males, 51 (60 per cent) in females.

"Age. Acquired diverticula of the duodenum are most frequently found in later life. Buschi states that 80 per cent of such sacculations occur after the age of fifty. Secher states that they have been found in infants. Simmonds says he has seen diverticula near the pylorus in very early childhood and therefore he concluded that they were con-

⁶⁰ Journal of the American Medical Association, November 27, 1920, No. 22, 75, 1463.

genital; he had seen them lower down in the small intestine only in old persons. In this series the average age has been fifty-six years.

"Contents of the Diverticulum. In 2 cases reported in the literature the sacs have contained gall-stones, 1 in one instance, 22 in the other. Usually the contents are chymous. After an opaque meal, it is possible to find barium in the diverticulum for many hours and sometimes for several days. In 1 of his cases barium was still to be seen in the sac on the seventh day. Retention of barium beyond forty-eight hours is not unusual. The average emptying time of the sac in eighteen consecutive cases was eleven hours. The normal emptying time of the duodenum is from four to five hours.

"Description of the Sac. The opening between the duodenum and the sac may be large or small, rounded, fissure-like or irregular. When the opening is very large, it is naturally difficult to keep barium in the sac long enough to make roentgenograms showing the condition.

"In many instances of diverticulosis of the second portion of the duodenum, the common bile duct and the pancreatic duct lie in very close relation to the wall of the sac, one or both sometimes traversing the lateral wall, or even emptying into the fundus of the diverticulum." Case described this technic, already then in use by him for five years, at the 1915 meeting of the American Roentgen Ray Society.

"The patient, standing erect before the fluorescent screen, swallows a third of a glass of water into which has been stirred a heaping tea-spoonful of barium sulphate. The pyloric region is carefully watched for the behavior of the first of the opaque mixture to reach it. This barium-water mixture usually begins to pass at once into the duodenum, so that it is more or less well visualized from the very beginning of the meal. This is followed by the usual barium meal, which in our practice consists of 1 ounce of barium sulphate in a glass of hot malted nuts or hot malted milk and 1 ounce in a glass of buttermilk given cold. A brief further observation is made with the patient erect. He is then placed on the horizontal fluoroscope, and, if any delays are necessary, he is asked to spend the time lying on the right side so that gravity may aid in filling niches or sacculations in the pyloric zone. When all is ready, so that the observation can begin the moment the patient turns over, the observer, standing at the patient's left, with his gloved left hand makes strong pressure over the duodeno-jejunal junction, at the same time pressing toward the pylorus the contents of the stomach. The patient is then asked to inhale, hold the breath and turn quickly on the back, special care being taken the while to maintain compression of the duodenum between the palpating hand and the spine, thus artificially producing an obstruction near the duodeno-jejunal junction, and incarcerating the duodenal contents. A wooden spoon may be used in place of the hand, if preferred.

"Only by the use of this special technic have we been able, except by accident, to discover the diverticula of the third portion of the duodenum near the duodeno-jejunal junction. Attention is called to the fact that this technic can be followed out only fluoroscopically. If one depends only on roentgenograms, the majority of the diverticula of the third

portion will be hidden by the overhanging or overlying portion of the gastric shadow and escape detection."

Having discovered a diverticulum, one should note (*a*) its exact location; (*b*) its size and general shape; (*c*) the dimensions of its orifice, whether narrow or free; (*d*) its mobility under the examining finger, guided by the fluoroscope; (*e*) the degree of retention; (*f*) relation of the shadow to a point of abdominal pain on pressure; (*g*) caliber of the duodenum proximal and distal to the diverticulum; (*h*) emptying time of the stomach.

Less frequently than in the duodenum the condition can occur lower down in the tract, and Case was able to recognize some 5 cases in the jejunum and ileum—although he makes the statement that these were the first that were recognized with the roentgen ray.

Undescended Cecum and Vermiform Appendix. Jonas⁶¹ discusses two cases of undescended cecum and vermiciform appendix.

The first case was one in which a woman of forty-five years had symptoms pointing either to an infection of the gall-bladder or duodenal perforations. She refused operation, and necropsy revealed an abscess under the liver, and in the cavity reaching from its top to the cystic duct was a gangrenous appendix.

The second was the case of a farmer, aged forty years. His pain developed in the right iliac fascia and extended upward to the right costal margin, but the tenderness, while moderate in the lower right quadrant, was most intense in the right hypochondrium where a mass was probable. Operation revealed an abscess under the liver containing a necrosed perforated appendix.

In both of these cases, which can be explained in the light of arrested embryonic development, the infection took place in exactly the same manner as if the organs had been in their usual, normal place. In fact, a study of the first case revealed practically an absence of the descending colon. The transverse colon ended in the cecum lying immediately below the right lobe of the liver. Inasmuch as the rotation of the colon and the descending of the cecum occurs in about six months, it becomes clear that in this case the process of rotation ceased at the fifth month of embryonic life at the time when the cecum arrived at the point immediately beneath the liver. Consequently, one might rationally employ the term undescended cecum and vermiciform appendix as well.

The author claims that infection of the appendix in its abnormal position is practically as frequent as the same condition in normal position. He has encountered 11 cases, 4 of the acute suppurative and gangrenous type, 6 of the chronic, nonsuppurative type. Three of these were found in the gall-bladder region and associated with gall-bladder infection. He has encountered the appendix in all localities between the right kidney and the left ovary, but in all of these the cecum was found to have descended, sometimes with excessive mobility. The author mentions the fact that Pottenger says "no matter where the appendix lies, whether it be on the left side of the body or in the right side,

⁶¹ Journal of the American Medical Association, No. 26, vol. 76, p. 1821.

or whether it be high or low in the abdomen, the natural place for the pain is in the right lower quadrant of the abdomen. Experience seems to bear out this view. Right-sided muscular rigidity and hyperalgesia through sensory afferent impulses are usually induced in the ganglions that control the cecum when normally located; they may be traced centrally to the lower dorsal segments reflecting efferent stimuli to the abdominal muscles overlying the appendiceal area, inducing a rigidity in the onset, and depend in their intensity on the severity of the pathological condition. Aside from the right iliac hyperalgesia, there was a second tender point, in our acute cases, directly over the actual location of the appendix and to a very much lesser degree in the chronic type.

We have learned that when the right subcostal tenderness seems the more severe of the type, the probabilities point to the primary infections being located in the right hypochondrium, which should be the point of operative attack.

Ileal Regurgitation, Nerves and Diet in the Chronic Intestinal Invalid. Bryant⁶² discusses the question of ileal regurgitation. He decries the present attitude of the medical profession to overlook this important condition and attempts to point out the ease with which it can be recognized and the means to be employed in combating it.

Diagnosis of this condition is based on the following procedures:

1. The sign which Hertz pointed out which is carried out as follows: One hand is pressed deep across the middle of the ascending colon to block possible distal expulsion of gas in the cecum. Downward pressure with the other hand in the direction of the pole of the cecum will then, if regurgitation exists, result in coarse crepitus and perhaps a gurgling noise as the cecal gas is forced back into the ileum.

2. Gas is not usually present in the small intestine. The presence of generalized gas throughout the abdomen suggests a deficient ileocecal mechanism.

3. A cecum and ascending colon filled with gas combined with a spastic descending colon frequently accompany ileal regurgitation.

4. In the presence of this condition, the hepatic flexure and the sigmoid loop are filled with gas.

5. A generalized yellowish discoloration of the skin, especially in the distribution areas affected by Addison's disease, is usual.

6. The eye sign is positive. By the eye sign is meant a marked dirty discoloration of the whole of both eye sockets. This discoloration is not like any other discoloration of the eye according to this author. This sign is suggestive but not pathognomonic. It is practically always present varying according to the intensity and degree of such regurgitation. It may even be present when regurgitation does not exist. Should such a sign be present, treatment as for ileal regurgitation will cause a disappearance of this sign, although the sign disappears more readily when true regurgitation is present.

7. The usual complaints of the patient with ileal regurgitation are abdominal pain of various sorts, intestinal gas, constipation and nerves.

⁶² American Journal of the Medical Sciences, 1920, 160, 865.

Pain is encountered in this condition as a diffuse abdominal pain with gas in the cecum, hepatic flexure and the sigmoid; epigastric pain somewhat resembling the ulcer type; another type of transverse pain, such as might be expected with spasm of the transverse colon; and, finally, cardiac distress from an excessive amount of gas in the stomach.

8. The absolute diagnosis is made by *x-ray* examination. According to Bryant, the administration of the opaque enema is the most valuable single procedure available. If the terminal ileum is filled by regurgitation, it usually remains filled even after the entire colon empties from the cecum to the ampulla.

According to Case, Cole, Baetjer, and others, it would seem that regurgitation could be expected in 20 to 30 per cent of all gastro-intestinal cases, but in this group of 50 cases studied by Bryant, 80 per cent. showed this phenomenon.

The technic employed was as follows: A large rectal tube was used and the enema allowed to flow in until the cecum was barely well filled. The flow of the enema was then checked before any undue distension occurred. No manipulation was indulged in until it would be determined by inspection whether the barium suspension would be carried back into the ileum by reverse peristalsis, or antiperistalsis. Occasionally, a half minute would elapse before antiperistalsis would become active enough to produce visible ileal regurgitation. Only cases where antiperistalsis by itself and without external pressure carried the barium back into the ileum were recorded as having regurgitation. Cases showing regurgitation after changes in position or strains incident to bowel evacuation were not classed as having regurgitation. The emptying of the colon was observed by lowering the enema receptacle to the floor.

In but 1 case of the 50 observed was there no complaint of nerves. In the overwhelming majority of cases, there was present this nervous factor which the author believed was in a sense precipitated by the intestinal phenomenon.

TREATMENT. Treatment is divided into the early, intermediate and late stage of convalescence. In general, during the early stage, the objectives are external and internal rest, varied by carefully controlled periods of exercise. This means that after a few days of complete bodily rest, if this be deemed essential, the patient, if as usual ambulatory, takes up again his daily life, but with the work periods broken as nearly as possible by five-minute rests every half-hour during the day. This specification is based upon the principle that rest from fatigue is effective inversely according to the duration of the preceding fatigue periods. Internally, rest is obtained by the utilization of the simplest, softest bland diet which can be made satisfactory to the patient. At this time eggs, meat and fish are absolutely contraindicated, as being potentially putrefactive substances. The duration of the early stage of convalescence covers usually from one week to one month.

The intermediate stage covers perhaps the next two months of convalescence. During this period the diet is gradually amplified and the patient begins to approximate more nearly normal conditions in the

manner of his daily work. During this stage it is important to warn the patient that it is impossible to expect continuous recovery. The usual sequence of events is that the proportion of good days to bad increases, and that the intensity of the undesirable complaints becomes less. As a rule, there will be at least two or three opportunities to demonstrate to the patient the fallacy of his allowing himself full liberty of action simply on account of a sensation of wellbeing too early in the progress of convalescence. The invariable result of this procedure is subsequent collapse, or at least a definite setback in progress, and there is usually opportunity to prove that a single indiscretion may not be wholly recovered from for as much as one or two weeks. The word indiscretion is applied both to the expenditure of bodily and mental effort and to the excessive use of undesirable foods.

The late stage of convalescence covers from two or three months to a year or more, since if the patient has properly learned his lesson he may continue to improve in a general way over perhaps two or three years. This is a period of active experimentation on the part of the patient. Having learned his lesson, it is for him to determine how nearly he can approximate a so-called normal standard of work and then to realize that every excess beyond his own limit must be paid for by a relative return of the symptoms from which he has become free. It is therefore, for him to determine whether the emergency justifies the sacrifice which he knows must follow.

There are five totally distinct factors of value in treatment. These are grouped under the following headings:

1. Social.
2. Mental.
3. Dietary.
4. Orthopaedic.
5. Glandular.

These are discussed at some length in another paper, three paragraphs from which are here quoted.

"The dietary employed is based in part upon a consideration of the large amount of work by many reputable investigators, which tends to prove the ease with which the intestinal flora can be changed by a modification of diet, also upon a consideration of the fact that ileal regurgitation is an exceedingly common finding in the chronic intestinal type of invalid. Ileal regurgitation was, for instance, demonstrated in 80 per cent of a consecutive series of 50 chronic intestinal invalids. Eggs, meat and fish, as being potentially putrefactive, are at first absolutely excluded from the dietary and the use of milk is restricted to the amount ordinarily employed in cooking. After a few weeks of complete exclusion of the above foods it is very common to find that the patient's skin is distinctly less muddy. Slowly the yellowish color of the skin is replaced by white and then by pink, a transition which is greatly appreciated by the average woman patient. During this preliminary period of marked restriction of the diet, bran and the coarse vegetables are eliminated. No diet list is given, the patients being thus required to use their own brains in the working out of a suitable dietary. One

advantage of this system is that the patient gradually acquires an adequate dietary for which he has the least possible dislike. If the dietary actually employed by the patient is written out and continually checked up at successive visits, the results seem better from the point of view both of interest of the patient and of the physician, than if a diet slip is handed the patient at the first visit. Eggs, meat and fish are rigidly excluded from the diet for at least one month. During the latter part of this month, however, there is an increasing use of eggs as a flavoring in puddings or other cooked dishes, in which the eggs are finely divided by mixture with the various carbohydrates or vegetables. Meat gravies as relishes precede the use of meats as such. During the month of restricted diet, liberal use is made of two special articles of food in conjunction with the usual fruits, starches, vegetables and fats. These two articles are cream cheese (or perhaps the ordinary cheese when used as a flavoring in various cooked dishes) and gelatin. The frequent use of flavored gelatins in the form of salads or desserts is encouraged. The necessary minerals and the water and fat soluble vitamines are provided by the use of raw fruit and green vegetables and a good grade of butter. In this connection it is surprising to discover how few people are acquainted with the virtues, both from a financial and an economic point of view, of chopped raw cabbage. This food as a salad with French dressing has been taken time and time again without the slightest discomfort or after-effects by patients who had previously stated that they could not possibly eat such a coarse vegetable.

At the end of a month or six weeks, if the progress of the patient justifies it—as evidenced by decreased constipation, lessened irritability, lessened disturbance from gas, better appetite and sleep, better color of the skin, and fewer headaches—meat is put back into the dietary at first once a week. The intervals between the days on which meat is used are thereafter shortened according to circumstances but, in the chronic intestinal invalid it has been found most unusual, if meat, eggs or fish as such can be handled with comfort, more frequently than two or three times a week. The intermittent use of eggs, meat and fish has another virtue in addition to its economy and its tendency to discourage the growth of undesirable intestinal flora. If the patient has only to wait over one or two days of restricted diet before being allowed a day of full diet, there seems to be much less desire for large quantities of these potentially putrefactive foods, which are handled with difficulty certainly in all patients with demonstrated ileal regurgitation.

In practice, on completion of the history, physical examination and the routine roentgen examination of the gastro-intestinal tract, of which fluoroscopic study of an opaque enema is an essential element, the social and mental factors receive first consideration in the progress of treatment. As soon as these factors are, so to speak, stabilized, the diet is taken under serious consideration. In conjunction with diet, frequent use is made of mineral oil, agar, yeast, and atropin, and every attempt is made to take advantage of habit formation and the natural rectal reflexes. As soon as the diet has become satisfactory, the application of orthopaedic procedures follow, and finally comes the use of the glandu-

lar preparations when indicated. Thus, by the end of the first month or so, all five of these totally independent factors are being simultaneously employed in the effort to bring about as rapidly as possible an improvement in the general condition of the patient. Belts are rarely used, since they tend to decrease the faith of the patient in his own ability to carry himself through his day's work. Only slight attention is paid to the question of weight, provided there is not a progressive loss in weight. Not infrequently one may find an apparently healthy person of almost incredible thinness. On the other hand, excessive fat is no guarantee of health. Usually, however, the very thin patients will put on at least from ten to fifteen pounds in the course of a few months without apparent effort if otherwise satisfactory progress is being made.

Case, who has devoted serious consideration to this question, has stated that if the ileocecal mechanism is once incompetent it is always incompetent. This is doubtless true in the majority of cases, but not always, as indicated by a case reported by the writer, in which reexamination at the end of one and two years, of a patient with previously demonstrated ileal regurgitation, proved that the regurgitation was no longer present. Kellogg, one of the few persons in this country who has taken ileocecal incompetence seriously, has even advised operation for the restoration of the ileocecal mechanism. Without discussing the actual merits of this procedure, it may be stated that in practically all cases satisfactory results in the way of treatment have been obtained by the writer by non-surgical procedure. Numerous cases have been reexamined at various intervals after treatment. If the ileocecal mechanism is still found deficient, it has at least been found to be much less so than at the original examination, and there has also been observed in every case a striking improvement in the general tone and action of the colon. One may therefore say in regard to operative treatment that it is usually unnecessary, since satisfactory results can be obtained without it and in the absence of the risks involved by operation.

The summary of this author is as follows:

1. Responsible physicians refuse to become interested in a condition with a history dating back to the middle ages.
2. The conditions associated with, or resulting from, ileal regurgitation do not favor optimum functioning of the gastro-intestinal tract.
3. The patient with ileal regurgitation suffers usually from increased intensity of any nervous irritability to which he may be liable, during the continuance of untreated ileal regurgitation.
4. Immediate treatment of ileal regurgitation is by means of a simple, bland, non-putrefying diet.
5. Adequate treatment must consider every aspect of the patients welfare.
6. The results of treatment are indicated, as follows: Six per cent showed no improvement; 8 per cent showed improvement; 86 per cent are recorded as improvement plus; and 94 per cent are the number recorded in the total number improved. His conclusions are as follows:
 1. Ileal regurgitation is not a normal condition. Disregard of its existence does not promote health.

2. The existence of ileal regurgitation may be demonstrated with ease and certainty.

3. In unselected gastro-intestinal cases, a frequency of from 20 to 30 per cent may be expected, although this number was greatly enhanced in the author's series.

4. Marked improvement in the general condition of the author's series was noted in 86 per cent

Rontgenological Aspects of Lower Right Quadrant Lesions. Baetjer and Friedenwald⁶³ discuss the important subject of the diagnosis of lower right quadrant lesions from *x-ray* studies. They divided these affections as follows:

1. Appendicitis.
2. Incompetent ileocecal valve and ileal stasis.
3. Dilatation of the cecum with retention.
4. Adhesions and angulations.
5. Ulcerations due to tuberculosis.
6. Ulcerations due to carcinoma.

They used both the opaque media by mouth and the use of the same substance by enema.

1. APPENDICITIS. Pfahler's studies in acute appendicitis are referred to, in which he points out the value of the roentgen ray in differentiating acute appendicitis from lobar pneumonia for instance, and further establishing the differential diagnosis of acute appendicitis from other acute abdominal conditions by filling the colon with bismuth and determining the area of circumscribed tenderness.

In the study of *chronic appendicitis*, it is pointed out that study should be made in the prone position, preferably with the gloved finger or wooden spoon under the fluoroscopic screen. They recommend as the best time, the period in which the cecum is filled, usually six hours after the ingestion of the opaque meal. When the appendix remains visible more than a day or two after the bismuth examination, it is, in the opinion of these observers in proportion to its poor drainage, a dangerous appendix. On the other hand, in certain forms of chronic inflammation from obliteration of the organ, the appendix may not fill at all. In many instances palpation will reveal a retrocecal appendix, but, as Pfahler points out, if there is localized tenderness over a fixed cecum, even though the appendix is not visualized, it means a pathological appendix.

The frequency of visualization of the appendix by means of a bismuth meal varies from 35 to 90 per cent according to various authors. But the writers do not believe, and we are in hearty agreement with them, that not every visualized appendix is a pathological one. It can occasionally be fully visualized and yet lie perfectly free. On the other hand, when we see an appendix curled up and fixed in position, it means a pathological appendix. It may be partially fixed or fixed for its entire length, and may be simply fixed at its tip. The kinking of the appendix, when it remains constant is, according to Pfahler, a significant sign of

⁶³ American Journal of the Medical Sciences, vol. 160, p. 639.

adhesions; and when it constantly points up to the gall-bladder region, there is good ground for believing that it is pathological.

The tendency for the stomach under the screen to seek the lower right iliac fossa is presumptive evidence of the possibility of a lesion in that part of the abdomen. On the other hand, as pointed out by Carmen and Case, a markedly diseased appendix may not be at all visible on the screen and may reveal itself only by tenderness in that region. The possibility of chronic appendicitis simulating duodenal ulcer must also be borne in mind, even deformity of the bulb of the spastic variety may take place, leading to erroneous conclusions which can be only dispelled by repeated examinations.

2. INCOMPETENT ILEOCECAL VALVE AND ILEAL STASIS. This condition is indicated, according to the authors, by the fact that at the end of twenty-four hours the ileum is empty and yet at the end of thirty-six to forty-eight hours the terminal ileum is filled, indicating the presence of regurgitation from the cecum to the ileum due to an incompetent ileocecal valve. According to Case, in about one-sixth of 3000 persons the bismuth enema passed the ileocecal valve and filled the terminal ileum for certain distances. This was, however, in a very large group of varied gastro-intestinal cases. The ileocecal valve is normally competent. Case suggests that this examination be always carried out in the horizontal position, because accurate visualized palpation can be carried out under the screen. Not infrequently bismuth can be massaged back into the ileum, which indicates marked incompetency.

His method of testing the ileocecal valve is the following: The patient should lie supine on a horizontal fluoroscopic table. It is not necessary to introduce the rectal tube more than two inches. The container should not be placed more than two feet above the patient and the enema allowed to flow slowly, the course of the enema being watched on the screen. Ordinarily 1200 cc of the barium enema at 100 degrees will fill the colon, but, as these authors insist, the cecum must be well filled. Massage over the cecum is practised in the antiperistaltic direction. Sometimes, according to these authors, the patient is asked to lie in the right-sided position for ten or fifteen minutes until the cecum is filled. The bismuth meal, when ingested, collects in about four hours in the terminal ileum while in from eight to nine hours the ileum is normally free from its contents. Delay in its passage is occasioned by spasm, incompetency of the ileocecal valve, bands or adhesions, displacements, prolapse and tumors, while dilatation of the terminal ileum points to obstruction. In every case in which the status of ileal stasis is determined, the question of gastric evacuation must be considered, any undue gastric delay unquestionably producing ileal stasis.

3. DILATATION OF THE CECUM WITH RETENTION. Cecal stasis may be due to chronic appendicitis, and, on the other hand, it may be due to high grades of enteroptosis with low grade inflammatory processes. In many of these cases of cecal stasis, as the authors point out, there may be present regularity in bowel action with distinct retention, the retained material being grooved and channelled by the passage of material. In these cases likewise, the appendix is frequently removed

with no benefit to the patient. The important thing is not the position of the cecum, however, but the question of its function.

4. ADHESIONS AND ANGULATIONS can be detected by fixity of the organ and retention, and, inasmuch as the cecum and terminal ileum are common seats of adhesion formation, this finding is by no means uncommon.

5. TUBERCULOUS ULCERATION. Brown and Sampson pointed out the roentgen picture of intestinal tuberculosis giving as the important points the hypermotility of the bowel, in most instances barium in the sigmoid, a spastic condition the cecum and ceco-colon, and the irregular appearance of the bowel showing definite filling defects at the site of the lesions.

6. ULCERATION OF THE BOWEL DUE TO CARCINOMA. There is a definite persistent filling defect in all the plates, and, in addition, on fluoroscopic examination localized tenderness and fixation. It may exist a long time before obstruction occurs. The greatest care must be exercised in making the diagnosis, and a reexamination should always be made.

We consider this article as timely and adequately pointing out the possibilities of *x*-ray diagnosis in the lower right quadrant. More than this, the article brings out the essential points in their determination.

Cecal and Colonic Stasis and its Surgical Treatment. Duval and Roux⁶⁴ discuss constipation of the right colon and its surgical treatment. They point out the well-known fact that right colonic constipation is associated with phenomena of intoxication, and not infrequently infection of the organism. The other type, left colonic or sigmoidal and rectal stasis, is usually banal and purely mechanical. In the words of these authors, written in a previous communication, this aspect of the subject is discussed.

Cecal constipation is endowed with much more serious effects on the organism than any other form of constipation. An arrest of the fecal current at this point is followed by fetor of the breath, vertigo, general malaise, and not infrequently marked inanition associated with neurasthenic phenomena. In simple constipation, where the material accumulates in the descending bowel, the condition is readily supported, and it is not rare to observe in these individuals intestinal evacuations but once or twice a week without any untoward effects. We believe that the difference in the reaction of the individuals to these different types of constipation is due to the difference in the point of arrest of the material. In the lower bowel the material is dry and bacterial life is arrested; in the cecum the material is semi-fluid from the constant arrival of liquid material from the small bowel, the result being a persistent chronic intoxication with general toxic manifestations.

THE SYMPTOMS OF RIGHT-SIDED CONSTIPATION. In this condition there are three orders of symptoms each of them worthy of short mention. These three symptoms might be described as follows: Pain in the lower right quadrant of the abdomen; constipation alternating with diarrhea;

and, finally, a series of constitutional disturbances due to chronic intoxication and infection.

1. *Pain in the Right Iliac Fossa.* The constant pain in the right iliac fossa suggests the presence of chronic appendicitis to the patient and is exaggerated by muscular effort and the right-sided position. It always becomes more marked during periods of constipation. Frequently it will increase through the night and awaken the patient. It is therefore obviously associated with distension of the right colon and is aggravated by gaseous distension of the bowel. It is readily appreciated in the patient by, at times, a visible distension of the bowel, and almost always a palpable distension. It may be confounded with a tender movable kidney. Quite frequently the paroxysms are associated with marked retention, only to be followed in a few days by diarrhea. This pain is not limited to the cecum and right appendicular region, but usually extends along the entire length of the right colon up to the hepatic flexure.

2. *Proctologic and Radioscopic Character of the Constipation.* This form of right bowel disturbance is characterized by constipation alternating with diarrhea. Sometimes the constipation predominates so that looseness of the bowel only follows the use of cathartics. On the other hand, a day or two of constipation is followed by the most pronounced diarrhea. It follows, therefore, that the examination of the stools will give very different results depending on the time at which the movements are collected. During the period of constipation, there is little about the movements to suggest the cause of the trouble. In fact, the movements are converted into more or less scybalous masses; but during the diarrheal periods the character of the movements becomes distinctive. If the mucous membrane of the bowel is intact, the feces which are evacuated have the characteristics of the normal contents of the cecum; they are acid in reaction, contain considerable cellulose, are rich in starch, and show a number of the so-called iodophilic flora on staining with iodine. According to this author, the abundance of the volatile fatty acids may indicate to a certain degree the extent of fermentation at this level.

On the other hand, if the mucous membrane is altered, the movements are very considerably modified and the material albuminous in nature exuded from the bowel wall is mixed with the cecal contents. There is a predominance of the proteolytic organisms which inhibit the fermentative bacteria, the feces become putrid or fetid and alkaline in reaction, the iodophilic bacteria almost disappear, the volatile fatty acids are reduced to a minimum; and the development of ammonia products attests to the presence of putrefaction. Finally, when the mucosa of the colon is markedly inflamed, a continuous and false diarrhea may take place, with pasty, fetid stools, but the absence of cellulose and starches would indicate that they had remained a sufficient length of time in the colon to produce at least digestion of these elements.

By means of *x-ray* examination, both by means of the opaque meal and by means of opaque enemata, it is possible to demonstrate the presence of the retention and the nature of the bowel wall, whether

relaxed or spastic, and the degree of tenderness. In this article a number of detailed roentgenographic drawings are given.

3. *Toxemia.* The important point, according to these authors is the association of toxic and infectious accidents with the constipation. All the digestive products, proteins, fats, and carbohydrates can give rise to toxic decomposition products which can imperil the general health and these are most pronounced in their effect when the diarrhea is absent.

One of the most characteristic symptoms is the intolerance of the patient for the slightest degree of constipation. A day or two is sufficient to induce the presence of symptoms, such as headache, vertigo and dizziness, and abdominal discomfort. If the intoxication is persistent, a secondary anemia is almost sure to intervene, this type shows little decrease in the number of red cells, but the hemoglobin is decreased. During the exacerbations of the pain paroxysm with constipation, there may be a marked increase in anemia.

Naturally, the question arises as to what are the causes of this toxemia. Iwao believes that he has found an amine produced by intestinal bacteria, namely "p-oxy-phenyl-ethyl-amine" which appears in the decomposition and putrefaction of meat particularly at the expense of the tyrosin through the influence of the bacillus aminophilus intestinalis and the colon bacilli. Injected into the guinea-pig, it produces marked disturbances in the blood. Loeper, in his *Leçons de Pathologie Digestive*, described an anemia in the course of intestinal disturbances, and particularly with those associated with dilatation of the cecum in which there was produced an hemolytic substance with anemia and subicterus. Binnie, in 1912, described a modification of the leukocytes in intestinal intoxication. There was encountered a lymphocytosis.

There is an habitual cholemia with these patients, and the skin takes on a brownish appearance particularly marked at the folds, such as the axilla.

The intoxication of the nervous system is shown by the asthenia and nervous depression encountered in these cases. Finally, the upper digestive tract shows evidence of trouble. The tongue becomes coated, and the breath, owing to the elimination of volatile material through the respiratory tract, becomes heavy.

The appetite may be lost, and, in proportion as the cecum fails to evacuate material, the stomach slows up and gastric digestion becomes impaired so that during these periods there is encountered a weight loss.

Sooner or later, when these attacks are not adjusted, there supervenes in the evolution of the case the addition of a series of infectious conditions; sometimes, during the attack, evidence of pericolitis and slight temperature rises so that there is in reality a thermal form or rather a fibrile form of cecal constipation. Not infrequently the biliary passages become affected and the organisms are eliminated in the bile, bringing about a cholecystitis. Another frequently associated infection is a colon bacilluria, with an infection of the urinary tract.

Palpation recognizes readily the area of tenderness and also the distention of the right side of the bowel. It might be combined with

bimanual examination in which case the cecum can be recognized in many instances as descending down into the pelvis.

In the treatment of this condition, there are two solutions, one is medical, the other is surgical. The medical treatment in many respects is that of constipation, but there are certain cardinal principles which must be adopted. In the first case, it is essential to insist on a rather rigid diet. It must be remembered that most of the toxic phenomena are due to the decomposition of proteins and therefore these articles must be reduced to a minimum. Eggs should be cut out of the dietary and meats must be prohibited, even at times the use of milk must be curtailed. The idea in treatment is to cause a disappearance or rather reduction of the proteolytic organisms and to enhance the development of the acid group. In other words the carbohydrate form of dietary, with purées, and rice, macaroni, potatoes, and, in general, the starchy vegetables and cereals, with the exception of the types rich in protein, such as peas and beans, is the type of diet to be used. The inoculation of the patient with fermented milks, such as yoghurt, kefir, and koumyss, is naturally to be desired, or the bacillus bulgaricus can be given with lactose. As these authors point out, however, the conversion of intestinal bacteria to the acid and fermentative type can usually be accomplished by the exhibition of a carbohydrate diet and daily doses of lactose. The evacuation of the right colon can usually be obtained by daily small doses of castor oil in the morning and also the use of paraffin oil.

The article discusses the value of operative procedures in this condition, and recognizes their utility in cases in which adhesion formation, fixation of the bowel and atresia occur, but the fact remains that most of these cases are medical. There is much in this article which would fit in with the cases which every gastro-enterologist sees and in nearly all cases there is some form of diet and medication which will succeed in arresting, if not actually curing, this condition. The important point in these cases, however, is to realize their frequency and also the sequence of symptoms as they arise.

Contribution to the Pathogenesis of Membranous Pericolitis. Bolognesi⁶⁵ points out:

I. The study of the right iliac fossa has been enriched within recent years by several facts which have found their way into our conception of this part of the abdomen. Of these, the conception of chronic appendicitis, as a disease essentially chronic from its inception, is one. Another is the Lane kink—another is the chronic membranous pericolitis which Jackson described in 1909. This membranous pericolitis is a fine veil-like membrane, not very intimately attached to the serous surface of the colon. In the words of this author, it appears somewhat like an edematous arachnoid membrane, and the colon seems to be placed in a sort of diaphanous sack. The bloodvessels run more or less parallel to the grand axis of the colon. Quite frequently the cecum is free and the appendix may, or may not, be associated with inflamma-

⁶⁵ Arch. d. Mal. de l'App. Dig., 1920, 10, 595.

tory tissue. The symptoms of membranous pericolitis are as follows: Spontaneous pain in the lower right quadrant of the abdomen, usually higher than the appendiceal point—more intense, more diffuse, and more superficial than that commonly associated with appendicitis.

II. Hyperesthesia is higher and more diffuse than that seen in appendicitis.

III. Almost constantly absence of any rise in temperature, increase in pulse-rate, or leukocytosis.

IV. No evidence of muscular rigidity in the painful region.

V. Evidence of cecal stasis, and usually constipation alternating with diarrhea.

VI. Disturbances in digestion and evidences of autointoxication, such as asthenia, emaciation, and even nervous disturbances.

From the standpoint of *etiology*, this disease has been considered, first, as a congenital infection and as the result of embryonic rests. This view has been held by many observers. A second view is the mechanical factor in which the mechanical action due to visceral ptosis is invoked. A third assumption is that it is due to an inflammatory process resulting in peritoneal reaction. Finally, there is a theory which considers both the congenital and inflammatory phenomena as associated.

This author, after a careful study of this situation and careful rehearsal of the literature, comes to the following general conclusions: (1) Membranous pericolitis does not represent a morbid entity in itself; (2) Jackson's membrane can exist independently of all cecal-colic disturbances; (3) it represents, in all probability, a local malformation—in most cases probably congenital—less frequently acquired information in that region; (4) the syndrome described by Jackson is due to the production of a mechanical process (such as stagnation of the colon) in an individual having a pericolic membrane or an inflammatory process (such as colitis and appendicitis). This article is a particularly good résumé of this entire subject.

Painful Dilatation of the Large Colon. Gregoire⁶⁶ points out the tendency of modern clinicians to attribute pain in the lower right quadrant of the abdomen as due to appendicitis. He comes to the conclusion that "chronic appendicitis will lose ground as a diagnosis when more is known of the obscure pathology of the colon." In May, 1919, this same author pointed out the fact that cecal-colic dilatation, when diagnosed, was nearly always chronic appendicitis. Dilatation of the right colon is diagnosed by spontaneous or provoked pain in the right iliac fossa. From time to time, there are acute exacerbations of pain, suggesting acute appendicitis, but, in spite of the pain, at no time did these patients have elevation of temperature—and, no matter how intense the pain, there is no increase in pulse-rate and no rigidity of the abdominal wall. Furthermore, there is no one fixed point of tenderness, but the whole right side is tender, with maximum discomfort varying from place to place. Another point is that the tender area is very much larger than that encountered in appendicitis, and it

⁶⁶ Arch. d. Mal. de l'App. Dig., 1920, **10**, 456.

is possible to feel the soft resilient and tender colon which can be made to disappear by sufficient pressure. Almost always there is some distention in this region, which is either visible or palpable.

It will be recalled that Wilms and Stierlin discussed cecum mobile as sufficient explanation of the same, but Hausman was the first who did not believe that ptosis was alone responsible for the trouble. According to this author, the distention of the right colon is the sole cause of the trouble, while the ptosis and the abnormal mobility are simply associated phenomena. This author claims that ptosis alone is not the cause of the trouble—a contention with which we are entirely disposed to agree—and this ptosis only becomes painful when it is complicated by a kink. It follows, therefore, that cecal stasis is a consequence and not a cause, and the causes are multiple. They may be due to inflammatory bands in the neighborhood of the hepatic flexure, or they may be due to pericolic membrane (Jackson's membrane). Finally, it may be due to an abnormal position of the right colon, as a sequel to defective congenital formation of the mesocolon. Ptosis of the right colon may be partial or total. In partial ptosis simply, the hepatic angle is affected and the cecum is fixed in its position. The ascending colon is found in the iliac fossa in total ptosis. The cecum, ascending colon, hepatic colon, and the right half of the transverse colon have all dropped—so that in the upright position the ascending colon is found in the right iliac fossa and the cecum may be found in the pelvis. It is noted that dilatation of the duodenum is frequently associated with distention of the cecum.

The *diagnosis* of this condition is best made by *x-ray* examinations, and preferably by screen examinations. Forty-eight and seventy-two hours after the administration of an opaque meal, there was still bismuth in the cecum. Regarding the *treatment*, it is to be noted that while a properly applied belt, and sleeping hours in a bed with elevation of the feet may give relief, this author is most favorably impressed by the value of colopexy—and the ascending colon is the most easily attached. It is simply sutured to the posterior wall of the abdomen. Remarkable results are promised by this method of operation—and the pain, stagnation, and general toxemia disappear after such an operation. Several cases are given in detail regarding this means of treatment.

Mucous Colitis. Stauffer⁶⁷ insists upon the thorough examination of the digestive tract and, in fact, the entire organism in the study of these conditions. He claims that infection, plus incomplete elimination, are the common causes of mucous colitis, a truth which is slowly dawning in the minds of many clinicians. The infection may be from constitutional or local foci. The teeth, nose and throat should be the first which are investigated. Gall-bladder infections, according to this author, are by no means rare, and chronic appendicitis is the rule rather than the exception in this condition. The relation of an infected lower bowel to mucous colitis and appendicitis is worthy of notice. And in the words of the author, "in a tabulated list of 200 patients with mucous colitis who had formed the enema habit, 150 patients had had their appendices

⁶⁷ Journal of the American Medical Association, November 27, 1920, p. 1496.

removed, while many of the remaining 50 would have profited by parting with theirs. No amount of dietetic or local medication will be of any value until the infection is located and removed. Cathartics add insult to injury, and are mentioned only to be condemned."

We believe that this statement cannot be mentioned too strongly, and are in entire agreement with the author that the whole trend of modern investigation, particularly that in France, points out the association of infection and stasis as the two overwhelmingly frequent points associated with mucous colitis.

The following method of *treatment*, modified to meet individual needs, is recommended by the author: A non-protein diet is selected with the object of producing a fecal residue of non-irritating bulk rather than the coarse indigestible dietary so frequently recommended for these cases. Bran should be ground fine and thoroughly cooked. It should be grouped with other foods and never given as an exclusive diet. The petroleum oils are of doubtful value, they do not empty the bowel, and often act as local irritants. An enema of 1 quart of 10 per cent magnesium sulphate solution, preceded by an antiseptic rectal irrigation, should be repeated until the solution is returned without feces. After resting for several hours, the patient is placed in an elevated Sim's position and a 10 per cent solution of oil of eucalyptus in olive oil is administered. The patient is requested to remain in this position for at least two hours. Local treatment is administered through the proctoscope by means of compressed air. Persistency in treatment and a regulation of surroundings, and not infrequently a change of environment, will certainly combine to relieve most of these patients.

Rectal Feeding as Compared with Mouth Feeding. Cornwall⁶⁸ discusses the important question of rectal feeding, its possibilities and its limitations. He mentions the fact that all food introduced into the rectum must be in a condition suitable for immediate absorption; that is to say, predigested. We know that adequate predigestion of protein and carbohydrate is practicable, but not apparently of fats. Salts and vitamines are absorbable in their natural state.

The plan for rectal feeding is based upon milk, the only other available source of perfect protein being from meat and egg, both of which are less desirable because they have a greater tendency to undergo putrefaction. Skimmed milk should be used, and it should be fresh and unheated because any considerable amount of fat introduced into the rectum cannot be used and may be harmful. On the other hand, the carbohydrate in milk lactose, according to this author, is not available as ordinary fuel, but, because of its ability to undergo lactic acid fermentation, may perform a useful function in keeping down fermentation in the bowel. Dextrose in solution supplies carbohydrate in a perfectly available form. Salts of a desirable nature can be obtained from milk and also from strained fruit juices, as well as the addition of sodium chloride and sodium bicarbonate. Vitamines of the fat-soluble A, and the water-soluble B, varieties are supplied by milk, while the water-soluble C

⁶⁸ International Journal of Gastro-enterology, No. 1, vol 1, p. 92.

vitamine is generally supplied by fresh fruit juices. Strained juices of fresh roots and green vegetables may be used to supply vitamines.

The following prescriptions are recommended for rectal feedings. They comprise three general types. One aims to supply the fullest and most correctly balanced ration possible under conditions of rectal feeding. The other supplies dextrose, salts and water but no protein, and one supplies salts and water only.

"Prescription No 1. Rectal." Protein, presumably in the form of amino-acids, 20 gm.; fat, available, 0; carbohydrate in the form of dextrose and levulose, 96 gm.; water, 1500 gm.; calories, 460.) At 6 A.M.—The following mixture in an enema: Dextrose, 1 oz. (30 gm.); strained juice of orange, 1 oz. (30 gm.); sodium chloride, 22 grains (1.5 gm.); sodium bicarbonate, 22 grains (1.5 gm.); water, 9 oz. (270 gm.). At 8 A.M. Skimmed fresh milk, thoroughly pancreatized, in an enema, 5 oz. (150 gm.).

At 12 M. The same as at 8 A.M.

At 4 P.M. The same as at 6 A.M.

At 6 P.M. The same as at 8 A.M.

At 10 A.M. The same as at 6 A.M.

At 12 M. The same as at 8 A.M.

Prescription No. 1 is a standard prescription for rectal feeding. It can be modified in various ways, as for example:

Every second day a colonic irrigation with normal saline solution may be given at 4 A.M., with, or without, the omission of the dextrose enema at 6 A.M.

The dextrose enemata may be omitted and the milk enemata increased in number to six daily, given at four-hour intervals, with, or without, increase in the quantity of each enema up to 8 oz. (240 gm.).

To each milk enema in prescription No. 1 or the above suggestive modifications may be added dextrose, $\frac{1}{4}$ oz. (7 gm.). Such addition would increase the fuel value of the prescription by 120 or 170 calories.

Calcium chloride, 5 gr. ($\frac{1}{3}$ gm.) may be added to each dextrose enema.

The sodium bicarbonate in the dextrose enemata may be increased in amount.

Prescription No. 2. Rectal Dextrose. (Protein, 0; fat, 0; carbohydrate in the form of dextrose and levulose, 192 gm.; water, 1800 gm.; calories, 768.)

At 6 A.M. The following mixture; dextrose, 1 oz. (30 gm.); strained orange juice, 1 oz. (30 gm.); sodium chloride, 22 grains (1.5 gm.); sodium bicarbonate, 22 grains (1.5 gm.); water, 9 oz. (270 gm.).

At 10 A.M. The same as at 6 A.M.

At 2 P.M. The same as at 6 A.M.

At 6 P.M. The same as at 6 A.M.

At 10 P.M. The same as at 6 A.M.

At 2 A.M. The same as at 6 A.M.

Prescription No. 2 is adapted for use in cases where dextrose and salts are specially required, as in acidosis. It can be modified in various ways, as for example:

The quantity of each enema may be increased to 12 oz. (360 gm.)

or more, the proportions of the ingredients being kept the same. Such increase adds 150 or more calories to the fuel value of the prescription.

The quantity of each enema may be reduced to 8 oz. (240 gm.), the proportions of the ingredients being kept the same.

The percentage of dextrose in the enemata may be lessened.

The amount of sodium bicarbonate in each enema may be increased up to 60 grains (4 gm.).

Calcium chloride, 5 grains ($\frac{1}{3}$ gm.), may be added to each enema.

Prescription No. 3. Rectal drink.

At 6 A.M. Normal saline solution in an enema, 16 oz. (480 gm.).

At 12 M. The same as at 6 A.M.

At 6 P.M. The same as at 6 A.M.

At 12 M. The same as at 6 A.M.

Prescription No. 3 can be modified by shortening the intervals between the enemata and lessening the quantity of each, and by adding sodium bicarbonate or other salts.

The enemata should be introduced slowly and at a temperature of 100° F.; the buttocks should be elevated, and the patient should lie on the right side for an hour after the injection. If the rectum is particularly irritable, it may be desirable to add a few drops of tincture of opium to the enema, or to give morphine by hypodermic injection; but usually little difficulty is experienced in retaining these enemata.

Diagnosis of Dysentery by Means of the Sigmoidoscope. Hurst, in a letter to the editor of the *Lancet*, June 4, 1921, p. 1211, discusses the question of the diagnosis of dysentery by means of the sigmoidoscope, a subject which Man, Sanbar and Gregg discussed in the *Lancet* on June 28th, 1921. Hurst has had an unusual opportunity of examining actual ulceration of the bacillary type of dysentery and claims that the principles of this type are identical with that observed in ulcerative colitis. The ulcers are shallow, irregular in outline, vary in size, and are separated from one another by swollen, deeply congested and easily bleeding mucous membrane. Amebic ulcers are generally more regular in shape and deeper, and the intervening mucous membrane is normal in appearance offering a very decided contrast to that of bacillary dysentery. He mentions the fact that he has also seen a very early stage of amebic dysentery in which small round projections from the mucous membrane are present, some of which show a minute central area of necrosis surrounded by a red areola, such as has been described in Roger's book on the dysenteries. He mentions the fact that it is interesting to watch the healing of amebic ulcers under emetine and bacillary ulcers under anti-dysenteric serum.

Quite apart from the question of the diagnosis of these ulcers, the author considers the instrument of the greatest value in determining the question of cure.

Treatment of Chronic Amebic Cyst Carriers. McVey⁶⁸ studied the students and attempted to study the question of student carriers. Six or more stools were submitted for diagnosis. It is pointed out that the cysts may disappear for a time only to reappear in cycles.

The author states that subsequent observations will probably show that 60 per cent will be too high a percentage of cure, as some of the cases observed after an interval of thirty days may relapse. One case included in the report relapsed after an interval of ninety days, ten negative stools having been obtained in the *interim*.

It is an important point to know at what period following treatment a patient may be safely discharged as cured, a point that has never been definitely determined. Certainly thirty days is too short a period of observation. The 14 relapsing cases were treated with neosalvarsan given intravenously in dosage of 0.3-0.5, and in observing 10 of these cases a record was made. These patients received neosalvarsan intravenously at four-day intervals, and during the time when the bismuth-emetine-iodide and emetine treatment was being administered. All of the patients were cured, the minimum period of observation being sixty days.

The results obtained bear out the contention of Gunn as to the efficacy of neosalvarsan as an amebicide, but it is quite possible, judging from the results obtained in the 7 cases, that neosalvarsan given alone at proper intervals and in proper dosage may be effective without the use of emetine or bismuth-emetine-iodide, but further observations are necessary to determine this point.

The Effect of Hookworm on the Blood Picture. Leger⁶⁹ discusses the effect of the hookworm on the blood picture. The studies in this instance were made on French convicts at Guiana and only those cases in which the ova of these parasites were found in the stools are included. It was remarked that there are three kinds of cases, carriers without clinical symptoms, carriers with clinical symptoms, and cases showing septicemia due to the inoculation of pathogenic organisms by the worms themselves.

In practically every instance there was an anemia associated with a leucopenia. There was furthermore a marked deviation of the Arneth formula to the right. The worms produce considerable oozing of blood, with a resulting anemia, and also secrete a toxin which is absorbed into the circulation. It is claimed that at first, owing to compensatory hyperactivity of the bone marrow, there is an increase in the red cells, followed afterward by a marked drop in the red count. Furthermore, the lymphoid structures are affected so that they lose the power of manufacturing leukocytes and a leucopenia is the result. There is then present a decrease in the young neutrophiles, with a proportionate increase in polymorphonuclear leukocytes.

Dysentery. The use of non-specific proteins in the treatment of dysentery has been extended to the treatment of many conditions. Homo- and heterogenous normal serum, peptones, milk, bacterial vaccines of non-specific type have all been applied in this manner and many of the chronic affections, such as arthritis, asthma, skin conditions such as eczema have been treated in this way with a fair degree of success and in certain cases rather brilliant results. Danysz⁷⁰

⁶⁹ Jour. d. Sc. Med. de Bordeaux, May 15, 1921, **42**, 230.

⁷⁰ Presse Med., May 7, 1921, **29**, 362.

discusses the use of non-specific proteins or "entero-antigens" in the treatment of an extensive epidemic of dysentery in Poland. In this epidemic which, owing to its extent, rendered specific bacterial therapy difficult, excellent results were attained in this way.

Strasburger⁷¹ discusses the sequelæ of chronic bacillary dysentery. This author claims that about 5 per cent of cases are chronic from the start while others apparently recover, but relapse after a time. Three types are distinguished, an ulcerous, dyspeptic, and a spastic form of pericolitis. The ulcerous type is that which gives the mucopurulent and bloody stools and which gives the characteristic appearance of the mucosa. It may give but little evidence of general constitutional disturbance but it gives the small, shallow, bleeding ulcerations in the lower large bowel which are so characteristic of that condition. The severe cases give the temperature rises, tenesmus, blood and mucus intimately mixed with the movements and even pure movements of blood and mucus.

The dyspeptic cases, on the other hand, are distinguished principally by the fact that there is present obvious interference with food handling. They may be of the putrefactive or the fermentative variety, or both. These fecal types may change, and, with these findings, disturbances in the upper digestive tract are common. Not infrequently gastric achylia is associated and a study of the duodenal juices reveals a lessening in the output of the pancreatic ferments, particularly trypsin.

Chronic dysentery will make inroads into the general systemic state of the patient and produce toxemia, anemia, and even cachexia of severe type, so much so that a third form, namely, the toxic cachectic type, is recognized.

According to this author, the bacillus may disappear from the stools for weeks as the result of the development of anti-bodies; when these fail, the bacteria will reappear. Most of these cases show a positive agglutination reaction. Sometimes, when no agglutinins are formed, as in the severe cases, the other anti-bodies will also be absent, and the lack of these substances accounts for the continued local destruction and cachexia brought on by the bacteria.

In a second communication by Strasburger⁷² other sequelæ are discussed. Arthritis, conjunctivitis, and urethritis are assumed to be complications rather than sequelæ, and their association can be determined by taking cultures by means of a proctoscope. Bodily languor, mental lassitude, emaciation, myalgias, neuralgias are all included in the category of symptoms associated with chronic bacillary dysentery. These results, from a continuation of this disease, hypochlorhydria with a lessened resistance on the part of the upper alimentary canal to infections, the occurrence of gastritis of the chronic type, and enterocolitis. Unquestionably, the most common and persistent sequel is a chronic catarrh of the colon which persists long after all acute manifestations of the disease have passed away. While intestinal perforation is rare, punctate perforation, with adhesion formation and adhesive

⁷¹ Deutsch. med. Wehnschr. April 21, 1921, **47**, 441.

⁷² Ibid., April 28, 1921, **47**, 463.

peritonitis, may occur. Spastic phenomena in the colon are extremely common, and vomiting and bradycardia due to reflex irritation may occur.

Lichtenstein⁷³ claims that the type of dysentery occasioned by the severely toxic Shiga-Kruse bacillus, producing the form of acute intestinal disturbance so frequently fatal, is rare. Cases are known, however, in which this form of dysentery pursued a chronic course (the reviewer has at present writing such a case under observation which Kolmer has pronounced, from rectal cultures, as a form of this disease in which the acute phenomena were extremely limited and the whole course of the disease extending over a year was essentially chronic). In this case, the individual suffered an attack of acute dysentery in February of 1920, only to be repeated less severely in April and June, and in the later attack the Shiga-Kruse bacillus was found.

Regarding the AMEBIC FORM OF DYSENTERY, the general feeling regarding this disease at the present time, is that it is a systemic disease and by no means confined to the bowel. Like all essentially protozoan diseases, it is a chronic affection. There are many forms of this disease. According to Charpin⁷⁴ there is (1) a gastric type characterized by loss of appetite, pain after meals, regurgitation, vomiting, and almost always pain in the left iliac fossa; (2) a diarrheal form in which the manifestation is frequent evacuations; (3) an appendiceal form characterized by pain in the right iliac fossa; (4) a rectal form in which most of the symptoms are located in that region; (5) a form of pseudo tuberculosis in which the symptoms may be mistaken for tuberculosis. The diagnosis of all these types is only made by an examination of the stools for cysts or ameba. The general picture of abdominal cramps, general tenderness, semi-solid frequent movements is sufficiently well known, as is the anemia, the digestive disturbances and emaciation. True amebic dysentery is particularly characterized by periods of improvement followed by remissions in which the diarrhea is aggravated. Treatment consists of the use of ipecac, arsenic, salvarsan, giving the latter intravenously and the arsenic by hypodermic administration although in the chronic cases, better results are often obtained by giving these drugs by mouth.

Manson Bahr and Gregg⁷⁵ discuss the diagnosis of dysentery by means of the proctoscope. The sigmoidoscope by a single examination was able to make the diagnosis of 58 per cent of cases (100 cases) of dysentery, while in the same number on repeated microscopic examination, only about 30 per cent were positive. The appearance of post-bacillary lesions consists of the most part of granulation tissue and the acute inflammatory changes are due for the most part to secondary invasion of the lesion by intestinal organisms. In more advanced cases, the mucous membrane has a granular or glazed appearance, and even granular tissue of recent origin may be superimposed on a dense fibrotic membrane representing an extreme degree of chronic inflammation.

⁷³ Geneesk. tydschr. Ned. indie., Batavia, 1921, **6**, 41.

⁷⁴ Marseill. Med., June 15, 1921, **58**, 529.

⁷⁵ Lancet, London, May, 28, 1921, **201**, 1121.

Intestinal Ameba in Man. Fischer,⁷⁶ from an extensive experience in China and also in Germany, discusses the question of intestinal ameba and also the prevalence of amebic dysentery. The differentiation of the pathogenic from the non-pathogenic ameba is naturally one of considerable importance, but as there are some thirty different forms of amebæ described in the literature, it becomes evident that a knowledge of their morphology is of importance. The author describes the following different forms of intestinal amebæ known to occur in man; the dysentery ameba or entameba histolytica; entameba coli; endolimax nana; iodameba butschlii, and the dientameba fragilis.

While it is possible to infect rabbits and cats with the dysentery ameba, as a general rule it is difficult to cultivate these pathogenic ameba in the animal body. Even in human subjects, the infection with the entameba histolytica is at times a tardy one, the symptoms of dysentery appearing only some considerable time after infection. It is pointed out that the dysentery type of ameba was endemic in Germany, France, Switzerland, and England, and the war emphasized the frequency of these conditions. But, apart from the spread of this disease, people who never came in contact with tropical troops show this infection. For instance, the author examined 200 patients of an insane asylum and found 2 of them with cysts of the entameba histolytica; while in 5 other cases cysts of the same parasite were found together with cysts of the entameba coli and the endolimax nana. Only the entameba histolytica has been found in the tissues. The author gives the following rule for classification of the ameba. The vegetative ameba containing red blood cells are always the entameba histolytica; cysts smaller than 10 microns are caused by the entameba coli and cysts larger than 20 microns are not caused by the dysentery organism, but by the ameba coli. It is also pointed out that the entameba histolytica and the iodameba butschlii react to emetin.

HUMAN INTESTINAL PROTOZOA IN NORTH QUEENSLAND. Maplestone⁷⁷ found the following protozoal cysts in the examination of 500 members of that Australian community: entameba histolytica, entameba coli, lamblia intestinalis, tetramitus misnili, blastocystis hominis. It was noted that the proportion of infections among young people was higher than among adults; and that flies may be responsible for the spread of infection.

INTESTINAL PARASITES IN SOUTHERN BAVARIA. Jung and Sell⁷⁸ describe the characteristics of the parasites encountered in that region: for instance the ova of the ascaris lumbricoides have the swollen covering, brown pigmentation and oval form, and are different structurally, depending on whether or not they have been impregnated. The tricocephalus dispar is characteristic insofar as its ova are concerned; they are smaller than the ascaris, and have the cupped ends. Those of the oxyuris vermicularis are rarely seen because the ova are implanted near the anus. They have a double rimmed, almost colorless covering,

⁷⁶ Centr. f. All. Path. u. Path. Anat., March 15, 1921, **31**, 369.

⁷⁷ Ann. Trop. Med. and Parasit., February, 1921, **14**, 283.

⁷⁸ München. med. Wochenschr., April 29, 1921, **68**, 511.

and may, or may not, be pigmented. They are rarely seen. Protozoal cysts are difficult to find. The entameba coli and the lamblia were encountered, but the vegetative forms were rarely seen because they soon die. The cysts of the entameba are round and usually have eight nuclei, rarely two or four. These are readily demonstrated by treatment with acetic acid and staining with hematoxylin. There are, as is well known, two varieties of intestinal ameba: The non-pathogenic entameba coli and the pathogenic entameba tetragena or histolytica. The coli has eight nuclei and the later only four smaller nuclei. Both of these forms may be found together. The cysts of the lamblia intestinalis are much smaller and egg-shaped. An obliquely-running longitudinal band is characteristic, with two or four nuclei near the smaller end. Some 380 stools were examined and 139 carriers of parasites were found.

THE LIFE HISTORY OF THE ASCARIS LUMBRICOIDES. Stewart⁷⁹ describes the literature on this subject and describes the anatomy of the ascaris suilla duj. found after hatching in the intestines of the pig. He describes the development of certain organs of this parasite and the route taken by this parasite in its migration through the tissues of the host. The mechanism of the protection of the host against this parasite is also described. Among a large number of pigs examined in England, 16 $\frac{3}{4}$ per cent were found to be carriers of this worm.

Pathological Anatomy of Cancer of the Pelvic Colon. Moutier and Girault⁸⁰ points out that cancer of the pelvic colon is one of the most frequent forms of cancer affecting the body. Less frequent than gastric carcinoma, it is the next most frequent form of carcinoma of the colon to rectal carcinoma. In this communication the phases in the development of this growth are studied. Sigmoid cancer begins most frequently in the lower segment of the sigmoid, usually some 16 to 25 cm. from the rectum. Almost always it begins as a plaque or a more or less exuberant vegetation on the bowel wall which sooner or later leads to stenosis. Sooner or later the growth encircles the bowel wall so as to lead to an annular growth. This contribution is based on ten personal observations in the service of M. Mathieu and surgical services of Lajars and Ricard at Saint Antoine. In general, on opening the abdomen, one is struck by absence both of ascites and adenopathy which one might expect in this region.

While it is customary to describe a scirrhus and a medullary form, the majority of these cases were mixed. In the scirrhus form, it is customary to meet with a proliferation with little increase in surface, and little or no vegetation or ulceration, although the form is rarely pure and there is evidence of some ulceration. Externally, little change is noted in most instances, although this form leads to progressive narrowing of the bowel wall and induration. Quite frequently the lesion is masked in a thickening of adipose tissue which disguises it. If this portion of the bowel is cut, it is noticed that there is a projection of the lesion into the lumen of the bowel and that the wall is appreciably, but

⁷⁹ Parasitology, London, March, 1921, 13, 37.

⁸⁰ Arch. Des Mal. de l'App. Dig., 1921, No. 4, tome 11, 260.

usually not markedly, thickened. The cut surface is pearly and increased in consistency. In some cases the lesion progresses to a considerable degree, 2 cm. or more without actually stenosing the bowel or encircling it. On the other hand, the medullary type may reach large proportions in spite of the oft-repeated assertion that these lesions are small on the left side of the colon and large on the right side. These authors have noted on several occasions tumors of this type larger than a human fist. Externally, they are recognized as irregular lumpy tumors, the color of wine, more often pale and covered with a net work of blood-vessels. The external appearance of the tumor is most often deformed by a sclerolipomatosis which conceals it. Furthermore, the presence of marked stenosis is recognized as usually accompanying these tumors. When cut through, it is a hard, pale, lardaceous growth similar to the same lesion seen in the stomach.

When one examines this form of tumor from its internal aspect, several types are met with: Namely, the cancer in the form of a plaque, the cavity form of carcinoma and finally the vegetating or cauliflower type. In a general way, the principal point regarding carcinomata of this region is that they are essentially stenosing in their evolution. In the form of plaque cancer, the middle portion or the true neoplastic region shows usually irregular ulceration rarely profound and most often cup-like in character. Bordering this region are to be found fungosities and often a fetid exudate or sphacelus. The effect of these modifications is to give to the region a peculiar red, bloody, livid appearance even at times very dark in color. The cavity form is usually one of very rapid growth, with hard edges and a cavity filled with putrid, bloody and exudative material. The vegetative type is rare and shows the characteristic proliferation in the form of a cauliflower growth. Above the growth is usually noted dilatation of the bowel wall.

The growth extends almost always toward the rectum rather than toward the adjacent bowel. This invasion in the direction of the rectum is almost always made along the line of the mucosa. In other cases, in the region of the rectum, a series of metastases occur. It is suggested that invagination of the sigmoid directly into the rectum might directly engraft metastases to that region. In studying this growth, however, there are two points of interest, the way in which it becomes adherent to surrounding organs, and the way in which, in most instances, it becomes anchored in the pelvis. The modifications of the mesosigmoid are, in the main, responsible for the evolution of this phase of its growth. It will be recalled that there is a tendency toward invagination downward, and, furthermore, these tumors are associated with considerable sclerolipomatous tissue. It will then be noted that there is associated a pericolitis with this general connective tissue and adipose reaction with enlargement of the mesocolon and finally fixation of the bowel. Finally, when this tumor becomes imprisoned in the pelvis, it attaches itself with ease to the pelvic organs, the bowel, the bladder, and even the male prostate, and may, particularly in the medullary type, produce fistulæ. These fistulæ may be sigmo-parietal, sigmo-visceral, or sigmo-intestinal.

It may be stated, however, that pelvic colon cancer is a form of malignant neoplasm of slow evolution. Again, it is emphasized that adenopathy and ascites are rare in this form. Perforation and abscess occur, but these complications are almost always walled off, so as to reduce acute complications to a minimum.

In conclusion, the parallel is drawn between cancers of the rectum and cancer of the sigmoid. Cancer of the rectum is a rapidly-growing tumor, with precocious glandular extension and metastases; on the contrary, sigmoid cancer is relatively benign and the danger of this later type is not so much in the histologic type but in its great tendency to contract, with adhesion formation to other organs, followed by fistulous formation and infection.

This article has a summary of the histological findings of these growths which would be of interest to anyone studying this type of growth.

MacArthur⁸¹ discusses the case of volvulus of the colon and obstruction of the small intestines in a girl aged fourteen years. She had severe abdominal pain, vomiting and considerable abdominal distention, most pronounced in the center of the abdomen. There was no rigidity, but pain which occurred at irregular intervals. It was thought at first that the case might be an internal hernia but what actually occurred was a twist of the colon and cecum which incarcerated the upper half of the small intestine. This was the result of an abnormally large and immovable ileocecal segment.

A Lactose or Dextrin-laden Diet, Bacillus Acidophilus Implantation, and Clinical Results. In an effort to change intestinal flora from putrefactive to fermentative, the results obtained by N. Philip Norman,⁸² by the administration of *Bacillus bulgaricus* alone have never seemed to justify therapeutic enthusiasm. With the implantation of the combination of *Bacillus bulgaricus* and *Bacillus acidophilus*, good results were obtained. While producing a striking improvement in cases previously unimproved by orthodox drug methods, they nevertheless left something to be desired, from both the laboratory and the clinical standpoints. The author tends to favor *Bacillus acidophilus*. Strains of acidophilus which are not kept too long in a laboratory (non-competitive environment) seem to grow in the intestinal tract very much more quickly than those which have grown for a long while.

In attacking colon infection, the writer is now using only an isotonic solution at a temperature of 36° C., followed by an isotonic solution at the end of the irrigation (drainage) at a temperature of about 28° or 30° C., and of which the patient is given a quart or so. The cold water has a tonic effect on the colonic musculature, and facilitates a rapid, thorough evacuation of the solution, as well as of the fecal contents. After the expulsion of the latter, the patient is then injected with a solution of lactose and agar-agar. This, when retained, furnishes an ideal culture medium for the acidophilus. During the past five months the writer has been planting the acidophilus immediately after the first drainage, and has kept up the procedure until the laboratory evidences

⁸¹ Medical Journal of Australia, September 11, 1920, No. 11, 2, 244.

⁸² Medical Times, June, 1921, 49, 126. Abstract, American Institute of Medicine.

have conclusively shown a good acidophilus growth. Thereafter the drainage has been kept up purely for the purpose of free drainage, and continued until the patient's clinical manifestations have cleared up. In addition to these drainages and implants, the patient is placed on a fruit and vegetable diet, with the exclusion of practically all animal proteids except those contained in milk and the white meat of chicken and is given 10 or 12 heaping teaspoonfuls of lactose daily.

Two cases are cited in detail showing clinical results bearing out the method.

Studies on Intestinal Implantation of *Bacillus Acidophilus*. H. A. Cheplin and L. F. Rettger⁸³ state that *Bacillus acidophilus* is a common inhabitant of the intestinal tract of the white rat and of man, ordinarily present in very small numbers.

The administration of 2 grams of either lactose or dextrin to white rats, in connection with a basal diet of bread and meat, caused in three to six days a preponderance of *Bacillus acidophilus* in the feces. Feeding of maltose, sucrose, and glucose had no influence. Two cc of *Bacillus acidophilus* culture or suspension also effected a complete simplification of the intestinal flora. One cc of the culture and 1 cc of lactose or dextrin had a similar influence. Postmortem examinations showed *Bacillus acidophilus* to be distributed throughout the entire length of the intestines. *Bacillus bulgaricus* could not be implanted so successfully.

EXPERIMENTS ON MEN. Ingestion of 300 grams of lactose or dextrin for four to six days led to such a pronounced transformation of flora that *Bacillus acidophilus* entirely dominated the field which showed an almost complete suppression of all other viable bacterial types. The character of the flora remained so long as the carbohydrates were ingested.

One hundred and fifty grams of carbohydrate and 150 cc of *Bacillus acidophilus* also produced marked change. Three hundred cc of *Bacillus acidophilus* suspension also reduces flora to aciduric type.

The daily addition of 1 liter of milk soured by *Bacillus acidophilus* to an ordinary diet in one to six days established a non-gas-producing flora dominated by *Bacillus acidophilus*.

On the other hand, the ingestion of 1 liter of milk soured by *Bacillus bulgaricus* was not effective in implanting aciduric bacteria.

Occasionally 500 cc of *Bacillus acidophilus* milk was sufficient and at other times it was necessary to add 100 grams of lactose or dextrin to the 500 cc of milk. There appears to be a definite relation between the rate of absorption in the alimentary canal of the carbohydrate and its efficiency in transforming the intestinal flora. In other words, when *Bacillus acidophilus* predominates in the feces after lactose and dextrin feeding, reducing substances are present, whereas such substances are not present after feeding of maltose, sucrose and dextrose, which have no influence on intestinal flora.

The H-ion concentration of feces is not influenced by carbohydrate feeding or bacteria implantation.

Botulism. Randall⁸⁴ gives a detailed report of 15 cases of botulism which occurred in three groups: Four in Lowell, Mass., in 1912; 7 in Tampa, in 1916; and 4 in Maine, in 1920. The 4 cases in Lowell were members of a Greek family who ate blood sausage, and all of them died of typical symptoms of botulism. A careful examination of the sausage revealed the *Bacillus botulinus*. Pure cultures, from which a filtrate was prepared, were administered by mouth and intravenously to laboratory animals and produced death of those animals. It was shown in this case clearly that the toxin of the *Bacillus botulinus* was filterable, and its lethal qualities were not impaired by maintaining it at boiling point for ten minutes.

The second group were 7 Tampa sponge fishermen, 1 man was dead, and 5 severely ill, while a seventh was only slightly sick. This last individual had been slightly sea sick for two days and had eaten nothing. The story goes that immediately on entering port, the cook purchased some ham, eggs, and several other articles which were consumed by all except the sea-sick man. The men began to sicken on the following morning and experimental animals who were fed with some of the ham developed typical symptoms of botulism, and all died.

The symptoms of all of these fishermen were characteristic. They had diplopia, dysphagia, difficulty in articulation, in two instances nystagmus, and, in all, great muscular weakness. Symptoms related with the first, third, fourth, sixth, eighth, ninth and tenth cranial nerves were apparent. In 3 cases before death, there was paralysis of the diaphragm. There was no elevation of temperature except in 1 case, an individual with an intestinal disturbance; and none of these individuals lived over five days. The first to die lived only eighteen hours. The other group was observed in Maine and, while the evidence was incomplete, ham was suspected as the cause of the trouble. It is pointed out that there is no known antitoxin sufficiently powerful to save life when the well-known symptoms manifest themselves.

⁸⁴ Medical Record, November 6, 1920.

DISEASES OF THE KIDNEYS.

HENRY RAWLE GEYELIN, M.D.

NEPHRITIS.

Chronic Nephritis. The investigative work, both clinical and experimental, as it appears in the literature dealing with chronic renal disease during the past year has been characterized by an ever-increasing emphasis upon the importance of renal function. Although tests for renal function have been employed for many years, their general use has been restricted somewhat to the larger hospitals, but the flood of literature on this subject during the past two years shows how universally these tests are now employed by the medical profession at large. An extensive review of the literature of the past year shows that many workers have attempted to modify the accepted renal functional tests of today, chiefly by means of devising new excretory coefficients, but in some instances, by modifying the old tests dealing with the excretory coefficients of the more important nitrogenous waste-products such as urea, uric acid, salt, etc. A relatively smaller group of investigators have occupied themselves with the renal response to modifications of the "dietary test days," or to studying the excretion of certain dyes or foreign substances administered by mouth (sodium benzoate, etc.).

In addition to the above-described types of investigative work, there have been, more particularly in the German literature, a number of attempts made to modify the various histopathological classifications of chronic nephritis. Papers dealing with this phase of renal disease still continue to attempt to establish a more consistent conformation between clinical entities and histopathological findings at autopsy than has been possible in the past.

Ever since the day of Bright, the clinician and pathologist has been attracted by this problem and, although some advance has been made in our knowledge of the histopathology of renal disease, the very nature of this increased knowledge has made it more and more evident that it is not possible to correlate given clinical or functional entities with given histopathological entities in the kidney at autopsy, what has been most discouraging is the fact that neither the histopathological studies nor the clinical studies have added much to our knowledge of the etiology and early course of renal disease in man. The artificially-induced nephritis in animals has contributed a certain amount of valuable information to our knowledge of the effect of producing disease in certain functional units of the kidney and then noting the resultant changes occurring in the blood and urine. In none of the artificially-produced nephritides of animals with which I am familiar can any complete similarity be drawn with the type of chronic progressive

nephritis as it is observed in man. In those instances in which there is great functional and histological similarity between experimental and clinical nephritis, the progressive nature of the disease, as observed in man, has been lacking in the experimentally-produced nephritis of animals.

In spite of all attempts of the last five years to differentiate types of nephritis clinically, functionally or anatomically, the dictum of Christian in his Harvey Lecture of 1916 is still appropriate, and, lest many of us may be tempted to spend too much time in trying to classify nephritic cases according to the elaborate and ingenious methods of Volhard, Fahr, Widal, or many of the more recent investigators, it may be appropriate to quote at some length from Christian's article dealing with this subject:

"Though the experimental studies of Schlayer and his co-workers differentiated two very distinct types of renal lesion, the vascular and the tubular, and though with their methods of study each type was shown to cause very characteristic disturbances of renal function in animals, the value of these studies has been rather in re-arousing interest in the investigations of renal function in human nephritis than in furnishing us with the satisfactory functional classification of renal lesions in man. In each case of human nephritis both tubules and vascular apparatus usually are involved. The one structure or the other may be disturbed in greater amount, but it has not been possible, *except in very few cases*, to separate the patients with any sharpness into cases with tubular lesions and cases with vascular lesions in the sense of Schlayer and his co-workers. Two of the substances which they used for functional testing in animals have hardly in the human body measured up to the usefulness which might have been anticipated from the results in animals or which was claimed at first from their use in man. Schlayer utilized the time required for the excretion of a given amount of potassium iodide as an index of tubular efficiency and the time and amount of lactose excretion to indicate the efficiency of the glomeruli. We, like other observers, have used these substances in a very considerable number of patients, but gradually have discarded them as furnishing comparatively little useful information."

"Widal and his co-workers studied the renal excretion of sodium chloride and nitrogen and grouped their cases of chronic nephritis into those with deficient power to excrete sodium chloride, which cases usually showed edema as a chief symptom, and those unable to excrete nitrogen readily in which uremic manifestations generally were prominent. Our study of salt and nitrogen excretion, except in an occasional case, has not yielded any sharp differentiation of patients. There is an occasional patient with a marked inability to excrete sodium chloride who becomes edematous when sodium chloride intake exceeds sodium chloride output and whose kidneys show but little, if any, impairment of their function to rid the body of nitrogenous substances, but such cases often are not, strictly speaking, cases of nephritis, but rather patients with disturbed salt elimination and no more to be regarded as nephritis than would be cases of diabetes mellitus or diabetes insipidus. If the typical cases of chronic nephritis, whether edema is a prominent feature

or not, are investigated with respect to salt and nitrogen elimination, it has been our experience that in most patients both showed delayed excretion; in the earlier stages, salt excretion, rather than nitrogen excretion, is disturbed, but as the disease progresses nitrogen excretion becomes increasingly delayed until in advanced cases both salt and nitrogen excretion are markedly, and about equally, disturbed. We have not encountered cases of the type described by Widal with normal salt excretion and delayed nitrogen excretion.

"In all of the earlier functional studies of patients with nephritis, the desire to make an anatomical diagnosis has been prominent; sometimes it has been the acknowledged goal, at other times, though not so stated, it is evidently the aim of the investigator. Little by little it has become recognized that such an attainment has not been approached with any closeness, and I think by most investigators it is not now regarded as improbable that we will ever be able to correlate closely postmortem anatomical appearances with the functional disturbances of the kidney during life, at least so long as present pathological technic and classification continue in use. Improved methods of studying renal lesions, of course, may change these conditions at any time. In a number of patients we have had an opportunity to carry out a group of functional renal studies, and, on the death of the patient, have submitted the kidneys to pathological examination. In these patients there is no evident relation to be made out between anatomical changes in the kidney and antecedent functional disturbances in any selective sense that would justify an anatomical classification. In our experience, in a functional sense, patients do not separate themselves into distinctive groups; rather it is indicated that there is a progressive increase in functional disturbance with advance of the lesion, though there is an undoubted tendency for certain cases to show continuously a much more marked impairment of function measured by one set of tests than by another, indicating that functional disturbances depend on selective excretory activity and that were not the various renal structures pretty generally involved in nephritis, a more definite classification based on tests of renal function could be made.

"However, at the present time tests of renal function are of more value for indicating the presence of renal lesion, for measuring its extent and for indicating its management than as a means of classification of cases. For these purposes they add greatly to the value of our clinical study of patients with nephritis. Out of the various and very numerous methods of testing renal function certain ones have survived, either by ease of application or by reason of yield of information in proportion to the amount of labor they require. Some have been discarded because the same information may be obtained from simpler procedures, or from ones requiring less complicated and expensive apparatus or occupying less time to carry out. Others have been given up because they caused more discomfort and inconvenience to the patient than some other ones yielding the same information. Those that are still in use, though they yield much valuable information, are not thoroughly satisfactory and better ones probably can be worked out with our increasing knowledge of renal function under varying conditions in man and animals."

In Nelson's *Loose Leaf System of Medicine*, Frothingham has suggested a classification of renal disease which, although very general and purely clinical, is simple and more accurate than any of the various elaborate and inaccurate classifications of the past. Frothingham's classification is therefore given *verbatim* below:

I. Congenital Abnormalities in the Kidney.

II. Acute Toxic Nephritis.

This includes any temporary lesion in the kidney produced by the toxins of bacteria or other kidney irritants such as mercury, arsenic, ptomaines, the toxins of pregnancy, bile, etc.

III. Chronic Toxic Nephritis.

This includes the permanent progressive lesions in the kidney following after the repair of any acute lesions, or produced by chronic vascular poisons whatever they may be, or by metals, such as lead and mercury, or by toxins which may be elaborated during metabolic activity, or by the strain of performing its function, etc.

IV. Specific Diseases of the Kidney:

These include those conditions in which the pathogenic organism is actually present in the kidney. The organisms which more frequently produce kidney lesions are streptococcus, staphylococcus, pneumococcus, gonococcus, colon bacillus, and tubercle bacillus; more rarely the spirochetes of syphilis and actinomycosis.

V. Movable Kidney.

VI. Tumors of the Kidney:

These include benign and malignant tumors.

VII. Cysts of the Kidney.

VIII. Amyloid Deposits in the Kidney.

IX. Circulatory Disorders of the Kidney.

It will be noticed that Frothingham has omitted the term "nephrosis" from the above classification of the nephritides. This I believe to be highly desirable. The introduction of the term nephrosis into the already overburdened nomenclature of renal disease is not justifiable. It has led to endless confusion in the minds of many members of the medical profession. It is not a descriptive term in itself, nor does it serve to identify any definite clinical entity. If, by the term nephrosis, we understand that condition in which the patient is suffering from edema and albuminuria, without other subjective symptoms usually associated with chronic nephritis, it would perhaps be permissible to retain the term, but only as descriptive of a certain stage in the course of nephritis. Even in such case it would be of doubtful descriptive value. Actual observation does not establish such a condition of the patient as more than a relatively transient one, probably it is merely an early stage in the course of chronic renal disease. There is considerable clinical evidence to show that cases of so-called "nephrosis" (temporary edema and albuminuria) are modified forms of acute nephritis, or which, in turn may often develop into chronic nephritis. In fact, these hypotheses would seem far more probable than that nephrosis was a separate and distinct form of renal or metabolic disease. The evidence that it is

a distinct pathological entity is also inconclusive; as far as the histopathology of the kidney is concerned there is certainly no justification for the term either as a definite pathological entity associated with the assumed clinical entity, or as a definite pathological entity invariably associated with any one form of clinical nephritis. In order that the term should be definitely descriptive of a form of renal disease, it would seem only logical to exact, among others, the following requirements.

1. The condition must follow a definite clinical course with distinctive clinical findings.

2. The blood and urine findings must be distinctive of this condition.

3. It should be possible to correlate certain definite clinical and laboratory findings with certain histopathological conditions at the autopsy. That these requirements are not met with is obvious. All that can be established at the present time in regard to the condition usually described as nephrosis is that the prominent symptoms, edema and albuminuria, may disappear after many weeks or even many months under suitable treatment and the patient remain in apparently good health for a long period of time, but, on the other hand, many such patients are known to relapse into a chronic progressively fatal nephritis, and it is possible that under long periods of observation there would be many more such instances.

Epstein¹ continues to lay great emphasis upon the distinctive qualities of a certain form of nephritis and illustrates with 3 typical cases the changes in the blood and serous cavity fluids which he has pointed out before, and which has been alluded to in PROGRESSIVE MEDICINE, 1920. The markedly distinctive findings in this form of chronic nephritis are diminution of the serum protein with a striking alteration in the ratio of serum albumen to globulin, high cholesterol content of the blood and the marked loss of albumin in the urine. The characteristic clinical findings in these patients are, briefly: (1) Considerable general edema; (2) normal blood pressure; (3) absence of eye ground changes and (4) of the subjective symptoms of chronic nephritis. They differ from other cases of renal disease who may show similar "clinical" symptoms with edema and salt retention (*a*) in the character of the blood changes, and (*b*) in their striking response to the therapeutic influence of high protein feeding with low fat content of the diet, this, Epstein claims, will markedly ameliorate the conditions, and in most cases cure it. The disappearance of edema is quite striking; while albuminuria is much diminished. Epstein seems to ignore the possible harmful effect of an increase in the N.P.N. of the blood which may occur as the result of "high protein feeding," contending that the N.P.N. usually decreases as the edema disappears. Epstein is not definite as to the frequency with which this type of nephritis passes over into a true form of progressive nephritis. From the cases cited one rather infers that such an outcome is rare, and that this form of "metabolic nephrosis," if properly treated, shows no progressive downward tendency.

In another article entitled "Further Studies in Chronic Parenchy-

¹ Clinics of North America, 1921.

matous Nephritis (Chronic Nephrosis)" Epstein² states that the frequency of this condition in a series of 692 cases of nephritis is from 6 to 8 per cent. He also argues that the problem of this condition "resolves itself into five distinct propositions: "(1) That chronic nephrosis is a clinical and pathological entity; (2) that chronic nephrosis is essentially a metabolic disease; (3) that chronic nephrosis is characterized by definite changes in the protein and lipoid content of the blood serum; (4) that the water retention and the consequent edema in this disease is of extrarenal origin, and is due to reduced amount of colloid, and hence, a lowered osmotic pressure of the blood; (5) that the feeding of large amounts of protein in the diet is the rational therapy for this disease. The questions which have been raised in the literature have not altered my viewpoint concerning any phase of the subject."

Confirmation of all these conclusions must be withheld until further investigation into the nature of this condition has been made, and until it can be definitely established that high protein feeding is without harmful effect in all cases who show a low serum protein content of their blood. In the meantime, certain other considerations relative to this rather uncommon type of renal, or, as Epstein terms it, "metabolic disturbances" demand that we withhold for the time being unqualified acceptance of all the claims made by Epstein. These considerations are as follows:

1. Is the evidence so far deduced sufficient proof of the essential unity of the condition? Is the condition any more distinctive than is hypertensive nephritis, salt-retention nephritis, or any one of the various modified forms of chronic renal disease?

2. The fact that not all cases, even with typical blood findings, improve under the dietary regimen advocated by Epstein is evidence against its distinctiveness.

3. It is by no means established that this apparently mild and easily treated condition does not quite often pass over into a progressive downward type of chronic nephritis with hypertension. That this assertion is justified is suggested by the results observed in the only 2 cases studied by Bauman in the wards of the Presbyterian Hospital during the past year; the first patient, a woman, showed all the typical findings described by Epstein, but after many weeks of treatment which included long periods of high protein, low fat, feeding, transfusion and pituitary extract, etc., the patients general clinical condition gradually became worse and a hypertensive form of nephritis developed together with the typical eye ground changes of nephritis and severe headaches. The edema in this patient has steadily increased and after six months in the hospital she is still showing the characteristic blood changes described above. The second patient, a girl, seventeen years of age, has followed essentially the same course although she has not been in the hospital as long a time, the edema has been equally resistant to high protein feeding.

There can be little doubt that among the large numbers of cases of chronic renal disease there are a few cases who show the characteristic

² Proceedings of the American Society for Clinical Investigation, May 9, 1921.

blood findings described by Epstein, but it would seem that not all of such cases are relieved of their edema and albuminuria in consequence of high protein feeding or by blood transfusion.

PATHOLOGY. L. A. Turley³ believes that in the so-called chronic form of intestinal nephritis there is very little, if any, actual increase of the interstitial connective tissue in the kidney, *per se*, but rather an apparent increase produced first by shrinkage of the kidney, and, secondly, by the fact that as a result of the disease process in the kidneys there is a destruction of the functioning portions of the kidney—tubules and glomeruli—which are replaced by connective tissue. This added connective tissue makes up a large part of the apparent increase. The author claims that these replacements can be easily identified and that they form the largest portion of the total connective tissue seen; as proof of this assertion, careful morphological studies of chronically diseased kidneys which show reduction in the number of functioning units and the replacement of the destroyed units by connective tissue, are given. In further support of his theory that there is no proliferative disease of the interstitium *per se*, he claims that there is no analogous condition in other parenchymal organs except in tumor formation, trauma, chronic hyperemia, destruction of tissue by bacteria or other infective agents, retrogressive processes of tissue of which connective tissue forms the stroma, and action of unknown chemical substances. Aside from apparently careful examination of the morphological histology of many cases of chronic interstitial nephritis, there is no basis for the author's conclusions, which are derived almost entirely from analogy and deductive reasoning. However, it is important to emphasize the previously known fact that some of the apparent increase in connective tissue found in these kidneys is due to replacement of destroyed parenchymal tissue by scar tissue. In PROGRESSIVE MEDICINE, 1920, allusion was made to some interesting observations made by Baehr and Lande upon the occurrence of well-marked nephritis in 9 cases of streptococcus endocarditis. These 9 patients all died with definite evidence of renal insufficiency some of them with well-marked uremic symptoms. They formed part of a total of 77 cases who died from streptococcus endocarditis.

The kidneys of 23 of these patients had been carefully studied at autopsy by Baehr⁴ and reported in 1912. At that time they found that there was an embolic lesion of the glomeruli present in the kidneys of all of the 23 cases. Baehr believed that this lesion was characteristic of streptococcus endocarditis but since then he has found 1 other case that was not suffering from endocarditis but who showed these same embolic glomerular lesions in the kidneys. This latter observation forms part of a brief report made by G. Baehr⁵ during the past year. In this report he emphasizes two additional important findings regarding the embolic glomerular lesions in the kidneys of patients dying of streptococcus endocarditis, they are as follows:

1. Only in 6 cases of the main group of 77 cases "were as many as 60 to 90 per cent of the glomeruli involved in the embolic process. Because

³ Journal of the American Medical Association, 1920, **75**, 980.

⁴ Journal of Experimental Medicine, vol. **15**, p. 330.

⁵ Archives of Internal Medicine, No. 2, vol. **27**, p. 262.

of the almost universal involvement of the glomeruli in these cases, the microscopical picture appeared at first glance not unlike that of an acute or chronic glomerulo-nephritis, in fact in the 9 other cases alluded to above, and who died with symptoms of uremia, the typical glomerular lesions were obscured by a diffuse, practically universal, glomerulotubular damage, an acute glomerulo-nephritis. The present series of 6 cases differs radically from these, for on closer study and in accordance with the criteria just mentioned, it could readily be ascertained that the numerous glomerular lesions were all of the embolic type.

"In 4 of these cases in which death occurred in the bacterial stage of the endocarditis, all stages of the glomerular lesions were to be seen, the same microscopical preparation furnishing examples ranging from the most recent to the completely organized stage of the process. Often a single glomerulus would show different stages of involvement in different portions. Occasional normal glomeruli were to be encountered, but these, according to the recent work of Fahr, would not exclude a true glomerulo-nephritis of focal distribution. Of more significance, however, was the fact that the uninvolved portions of damaged glomeruli remained perfectly normal.

"In 2 other cases which terminated in death in what Libman has described as the bacteria-free stage of the endocarditis, only healed glomerular lesions were present. But these were so typical that the possibility of the lesions being due to an antecedent glomerulo-nephritis could be excluded. In these cases, also, the uninvolved portions of damaged glomeruli remained perfectly normal.

"2. The great numerical frequency of the glomerular lesions in the above 6 cases afforded an opportunity to ascertain the effect of such lesions upon the renal function.

"For present purposes, it is sufficient to state that except for slight albuminuria and microscopical hematuria, none of these cases manifested any symptoms which might be construed as indicative of a serious disturbance in renal function.

"In other words, even when almost all the glomeruli have been more or less damaged by this embolic process, the function of the kidney may be unaffected. The explanation is probably to be seen in the observation that, unlike in true glomerulo-nephritis, the uninvolved portions of the damaged glomeruli remain normal. Blood continues to circulate through these undamaged capillary loops, and this is apparently sufficient to maintain the normal glomerular functions."

A very striking feature, and one that is sure to impress any reviewer of the literature dealing with the pathology of nephritis, is the fact that during the past five or ten years purely histological studies of renal disease have thrown no new light on the etiology of nephritis except in that group of nephritis due to bacteria. Histopathologists have added to our knowledge of the details of the disease in the kidney itself. They are now from time to time helping us to isolate functional units in experimental nephritis but the limitations of technic, the diverse and complex clinical characters of the disease and the probability that parts of the body, other than the kidney, are functionally involved in nephritis have all combined to successfully prevent further advance along histo-

pathological lines. The result of this has been to produce in the literature of the pathology of nephritis an almost endless chain of papers which amount to nothing more than fruitless attempts to classify and reclassify kidney lesions and compare them with complex variable and ever-changing clinical entities.

It is to be hoped that the newer work of Richards on the kidneys of frogs in which new light is being thrown upon the fundamental physiological action of the renal glomeruli and the variations produced in them by certain pharmacological agents, (Harvey Lectures, 1920-1921) will help us to solve the problems of etiology and pathology in renal disease.

EXPERIMENTAL. L. Leiter⁶ in a systematically-planned series of experiments, has studied the effect of intravenous injections of large amounts of urea upon a group of dogs. He arrives at the same conclusions as did Marshall and Davis⁷ in regard to the amount of urea per kilo body weight that it was necessary to inject in order to produce what Leiter describes as "symptoms of uremia" (anorexia, vomiting, and restlessness, convulsions, coma, dyspnea and finally death). The amount found to be necessary by Marshall and Davis was 1 per cent of the total body weight of the animal. Leiter employed a 33 per cent solution of urea and gave almost continuous injections over a period of from two to six hours (as nearly as can be determined from the protocols given). The amount of urea injected varied considerably from 100 to 200 gms. according to the amount found necessary to produce "uremic" convulsions. The rate of injection was 2 gm. of urea per minute which made the fluid injection-rate approximately 6 cc per minute. Nine dogs were subjected to this procedure, while in 8 other dogs the urea was injected after the ligation of one or both ureters.

Rather broad variations of symptoms developed in all the dogs studied. The first symptom was salivation, this was quite a constant symptom; vomiting was also a fairly constant symptom, while the final symptoms usually encountered were dyspnea and convulsions. Twitchings and nystagmus often occurred, opisthotonus and diarrhea were less frequently found.

Bloody urine was a rather constant feature, and tremendous elevations of the urea content of the blood occurred in all animals, the lowest being .670 per cent, the highest 1.812 per cent. The necropsy findings were strikingly uniform in all of the first 9 dogs studied and included marked hemorrhage into the mucosa and submucosa of the stomach and small intestine, with necrosis of the mucosa in some areas, subpleural hemorrhage with varying amounts of hypostatic congestion, and edema of the lungs and very marked fatty degeneration of the limbs of Henle's loops with cloudy swelling of the convoluted tubules of the kidney. Thus it will be seen that the urea apparently acted as an endothelial cell poison, and also as a toxic agent for the renal epithelium.

Most of Leiter's conclusions are amply justified on the basis of the material presented. The analogy of this experimental uremia to the uremia seen in human nephritis is probably correct. Marshall and

⁶ Archives of Internal Medicine, September 15, 1921, No. 3, vol. 28.

⁷ Journal of Biological Chemistry, 1914, 18, 55.

Davis, alluded to above, had previously shown that 90 per cent of the injected urea was taken up by the tissues and they had estimated that it would take from four to six days of complete urea retention to cause an increase of the blood urea to 200 mg. per 100 cc. Also, the analysis of human tissues in nephritis shows a urea concentration about the same as that observed in dogs after lethal urea injections. The work of many authors has shown that the kidneys have an enormous power to excrete urea, in many instances as high as 40 gms. urea per liter, so that it can be readily seen what a large margin of safety is provided.

Kato and Watanabe⁸ believe that they have found a new and important substance in the blood of cases of chronic nephritis, which is not present in the blood of cases with acute nephritis. This substance is characterized by the fact that it increases the irritability of the sympathetic nerves as tested on the ganglia of cats. It is very labile and disappears from the serum after standing for twenty-four hours. It is destroyed by heating to 56° C. or by drying, it is highly resistant to cold and is non-dialyzable. The authors believe it to be an albumin, but not associated with the globulin fraction.

They emphasize the fact that this quality of the serum in chronic nephritis is not similar to the effect produced by adrenalin or adrenalin-like substances in that it does not possess the vasoconstrictor qualities so characteristic of these substances.

Squier and Newburgh⁹ in a logical continuation of their work on the production of "nephritis" in rabbits by long-continued feeding of a very high protein diet, have produced in 4 normal men by forced protein feeding (two meals) certain evidence of renal irritation. Mild cases of nephritis with hypertension who were also subjected to the same forced protein feeding showed an increase of albumin in the urine when albumin had already been present and the appearance of albumin in patients who had been free from it. Other evidences of renal irritation found in these patients were the appearance of red cells in the urine together with an increase in the engorgement and edema of the nerve head in the eye-grounds. There was no significant change found in any of the renal functional tests. These observations of Squier and Newburgh, while suggestive of the possibility that increased protein feeding is definitely and perhaps permanently injurious to the kidney, require further and more complete investigation.

RENAL FUNCTION AND NEPHRITIC DIETS. Ketel Motzfeldt¹⁰ in a paper devoted primarily to the therapeutic value of salt and protein restriction in chronic renal disease, discusses the therapeutic indications and contraindications for some of the well-known nephritic dietaries. Briefly summed up, they are as follows:

The sodium chloride content of the food is one of great importance in the treatment of all cases of nephritis. The rigid restriction of this constituent to 2 gms. or less per day is clearly indicated in all cases of nephritis with edema, but adherence to such a rigid salt-free diet, when there is no chloride retention and no edema, depends upon whether or

⁸ Ueber die Wirkung, etc., Tokio T. Exp. Med., 1921, **1**, 167.

⁹ Archives of Internal Medicine, 1921, No. 1, **28**, 1.

¹⁰ Acta Medica Scandinavica, 1921, **53**, 811.

not there is a lowered tolerance for salt, if so, the author believes that one should employ a strict salt-free diet day, at least once a week, with a moderate restriction on other days. By so doing, even the patients with a pronounced tendency to edema may be kept free from water retention in the ordinary occupations of life.

The author also points out that there is great divergence of opinion as to whether or not a protein diet is advisable in cases of so-called nephroses, some writers having advocated a high protein diet in nephroses with edema while others believe this procedure to be a very dangerous one, in any event the salt administered to such cases must be kept very low.

The effect of *low protein diet* (30 to 20 gms. per day, or even less) upon patients with nephritis and high non-protein nitrogen in the blood, are demonstrated. One patient, a man fifty-two years of age, admitted to the hospital with symptoms of uremia complicating a "chronic glomerulo-nephritis," showed a blood urea value of .245 per cent but after three months of low protein feeding the blood urea was reduced to .032 per cent. The phthalein test which on admission was 20 per cent, during the three months of treatment increased to a normal value. The clinical symptoms and general health improved correspondingly. Motzfeldt adds, "In several other cases where the azotemia has not been as pronounced, we have found similar effects; headache, nausea, vomiting, restlessness and fatigue have disappeared with nitrogen reduction."

The findings in this case of Motzfeldt's serves to emphasize two points which are not widely enough appreciated, namely:

1. High blood urea values in nephritis are often (more often than is commonly supposed) capable of being much reduced, and sometimes this reduction may be even to the level of a normal blood urea simply by reducing the proteins of the food to 20 gm. or even less. In many instances this low protein diet must be maintained for many weeks before a therapeutic effect is obtained. Even in the presence of nephritis of marked clinical severity characterized by pre-uremic symptoms and every evidence of striking loss of kidney functions, the persistent administration a very low protein diet for many weeks will in some cases produce the effect observed by Motzfeldt. The time element is an important one. It will be remembered that Allen has employed very low protein feeding with considerable success in cases of hypertension and a few cases of chronic nephritis. This article was discussed in PROGRESSIVE MEDICINE, 1920.

2. What most clinicians have hitherto regarded as a low protein diet in the treatment of chronic nephritis has been a diet made up of from 30 to 50 gm. of protein. That this diet may not be low enough in protein to produce therapeutic effect is amply illustrated by Motzfeldt's experience, quoted above, where a reduction to 20 gm. and less was necessary before improvement took place. The author warns against continuing a very low protein diet (15 to 30 gm.) for too long a period of time because of the danger of nitrogen loss from the tissues due to starvation. It might be added that low protein diets administered for any period longer than two or three days must be compensated for by

the addition of sufficient carbohydrate and fat to furnish the adequate number of calories necessary to protect loss of tissue nitrogen, which not only produces starvation effects but also increases the nitrogenous waste production, thereby defeating the purpose of the low protein feeding.

Another interesting observation made by Motzfeldt is that the "normal" range of non-protein nitrogen in the blood, according to his observations lies between .02 per cent to .04 per cent while the upper normal range for blood urea is .05 per cent, both these upper normal figures are considerably higher than figures found in so many of the more recent text books or as originally given by Folin as constituting the normal amounts of non-protein nitrogen and urea in the blood, but, in explanation of the apparent discrepancy, it must be remembered that Motzfeldt's normal figures were obtained from "normal" hospital cases (presumably free from nephritis).

Motzfeldt's figures for upper normal limits are in keeping with the findings actually encountered by many other observers who have had large clinical experience with hospital patients. Most clinicians do not regard a blood urea of 40 to 50 mg. per 100 cc of blood as evidence of nitrogen retention.

Maclean,¹¹ in the discussion of renal efficiency tests at the Eighty-ninth Annual Meeting of the British Medical Association finds, as the result of observations made upon "many cases," that 15 to 40 mg. of urea per 100 cc of blood is the normal range. Any value of over 45 mg. "is suspicious" and over 50 mg. indicates that the kidneys are insufficient. This author believes that the lower "normal values" are more apt to be shown the younger the patients, the higher values are more apt to be found in older people.

In another article Maclean and Russel¹² discuss the relative value of the three renal functional tests which they have found to be the most helpful.

These are: (1) Blood-urea, only found elevated in rather advanced cases. (2) Urea concentration test. (Estimation of the percentage of concentration of urine urea in one hour, after giving 15 gm. of urea by mouth). This test the authors found of value only when the blood urea was not elevated. (3) Amount of diastase in the urine.

Maclean believes that the "urea concentration test" is the most valuable of the various functional tests employed by him in determining early functional deficiency. The power of the kidney to concentrate urea in the urine up to 2.5 to 3 per cent is regarded by the author as normal. Any concentration of urea below these figures is regarded as at least suggestive of renal impairment. Maclean condemns the Ambard formula and all its complicated modifications. He says that the simple estimation of urea in the blood will give as much information as the Ambard formula in all cases of renal disease. Just why the author includes the diastase test among the three most useful and dependable functional tests is not evident from his discussions of this test in the article quoted. The material from which these studies are made is large, 10,000 cases of nephritis having been observed. This tremendous

¹¹ British Medical Journal, 1921, **2**, 425.

¹² Lancet, 1920, **1**, 1305.

number of cases at once suggests that careful observation and critical analysis of results has been lacking.

In the first paper of Maclean's alluded to above, the author confirms the experiences of many other observers, namely that the phthalein test for renal function is not of as much clinical value as we were once accustomed to believe. In our experience we have found that a very low excretion of this dye (10 per cent or less) is, of course, of definite value, and some impairment of kidney function is indicated by repeated observations in a given case of a phthalein excretion of less than 35 per cent. Maclean is inclined to believe that this test does not have a very important place among the various functional tests.

W. R. Ohler¹³ submits a very simple classification of nephritis which does not include the rarer forms of nephritis given in Frothingham's classification. Ohler's summary is as follows:

1. Acute Nephritis.
2. Chronic Nephritis with Edema.
3. Chronic Nephritis without Edema.

This author also has arrived at certain definite conclusions regarding the value of various functional kidney tests, his views are briefly as follows: *The blood urea* determinations are "of great value as an aid to treatment and prognosis but of only slight value as an aid to diagnosis." He believes that those cases of nephritis with nitrogen retention whose nitrogen retention can be controlled by dietary measures have, generally speaking, the best prognosis.

Estimation of fluid output together with salt and nitrogen excretion are of great diagnostic value when the intake of all three is known "over an observation period of days."

"*Two hour test day*" is of importance in diagnosis of early cases, but is of very little prognostic importance, also this test is of very little use as a guide to treatment. The diagnostic value of the test is somewhat impaired by the fact that fixation of specific gravity is also found in many cases of anemia, also in myocardial insufficiency.

My own experience has been that this test can also be greatly influenced in many cases by varying the fluid intake on the day of the test and also by varying the diet, exercise, and fluid intake for a few days before the test is given.

Ohler gives case histories of several cases where this test and some of the other functional tests were of no value either from the diagnostic or prognostic standpoint.

The phthalein test the author believes shows definite renal impairment when the reading for two hours is below 40 per cent. He says this test is "of some diagnostic importance and that it often gives valuable information concerning the progress of any given case. Its prognostic value is doubtful and repeated observations are necessary."

The above is a brief *resume* of the most important observations made on renal function published during the past year. Many others of equal merit have been reviewed, but they do not add anything essential to what has been given above. It would appear that there is an increasing unanimity among the majority of observers in their selection of func-

¹³ Clinics of North America, September, 1920, p. 517.

tional tests which are of practical help in the care of nephritis; the vast majority agreeing upon the great value of the following tests.

(1) Blood urea; (2) phthalein; (3) two hour test (Mosenthal); (4) estimation of salt and fluid balance on known intakes of these substances; (5) blood uric acid.

There appears to be an even more general unanimity of opinion as regards the value of these tests in (1) diagnosis, (2) in treatment and (3) in the prognosis of nephritis. In diagnosis, more particularly in early nephritis the functional tests are of little or no value. In the management of the case, these tests are, some of them, of great value. In prognosis they are also of great value when properly interpreted.

F. B. Kingsbury and W. W. Swanson¹⁴ propose a new test for kidney function,. The principle upon which this test is based is that sodium benzoate given to normal individuals in doses of 2.4 gm. per mouth will be completely synthesized and eliminated in the urine as hippuric acid. From 95 to 100 per cent of the sodium benzoate ingested is recovered in the urine as hippuric acid in three hours.

There were 10 normal individuals on whom this test was performed, and 7 cases of nephritis. Among the latter the excretion of hippuric acid was below 50 per cent in three hours. The phthalein tests done on the 5 of these same individuals showed readings which were all below 20 per cent. The estimation of excreted hippuric acid after doses of sodium benzoate has been used in the past as a test of renal function. The present authors show quite clearly that the discrepancy of results obtained by previous observers has doubtless been due entirely to faulty analytical methods, they have used the Folin-Flanders method of analysis which is accurate and reliable, but the objection to this method is the time required for one determination, roughly nine hours. This, the writers believe, they will be able to obviate by modifying the analytical method, until they do this, the test will not be available for routine clinical use.

Uremia. Foster,¹⁵ in a masterly review of this subject, divides the various clinical manifestations into three broad groups. First, the epileptiform or convulsive types, this being the first and the earliest recognized form. Headache, and the sudden onset of amaurosis, are the common precursors, and coma is the sequel. The convulsive seizures and not infrequent recovery are the striking features. Second, a type that never shows a sudden onset, the only symptom being gradually deepening coma which is not accompanied by evidence of motor irritation or psychic disorders. The third type is characterized by visual disturbances with certain changes in the eye grounds, and it is this type which most often produces gastro-intestinal symptoms and psychic disorders, convulsions do not occur and coma is terminal. Edema of the brain appears with constancy in the second type. Cerebral hyperemia is often, although not always, associated with the first type mentioned. Foster also reiterates the importance of not restricting the water intake in cases of nephritis who show retention of nitrogen because, without a sufficient quantity of water, the kidney is unable to rid the body of the nitrogenous waste product..

¹⁴ Archives of Internal Medicine, 1921, **28**, 221.

¹⁵ Journal of the American Medical Association, 1921, No. 5, **76**, 281.

GENITO-URINARY DISEASES.

By CHARLES W. BONNEY.

DISEASES OF THE KIDNEYS AND URETERS.

Renal Infections. During the last decade a considerable addition has been made to our fund of knowledge concerning infections of the kidney, not only with regard to their symptomatology and treatment, but likewise with regard to their bacteriology and morbid anatomy. Within that period, several contributions concerning the subject have been discussed in PROGRESSIVE MEDICINE. The importance of hematogenous injection, giving rise to suppurative nephritis, has been fully established.

In a recent paper by Hugh Cabot,¹ an attempt is made to classify these infections according to the different types of bacteria which cause them and also according to the tissue-changes which the infecting microorganisms produce. Thus, in one group, it has been found that the Staphylococcus and Streptococcus pyogenes are the principal causative organisms, while in another class the colon-typhoid family is responsible. The types of infection produced by these two groups are essentially different. In the staphylococcus and streptococcus infections, lesions close to the renal cortex are found, the morbid change being limited to that part of the kidney because the bacteria are not able to pass through into the deeper tissues. They give rise to circumscribed areas of suppuration, characterized by multiple subcortical abscesses, and subsequent perinephric inflammation which may progress to suppuration. In this type, Cabot states that the urine may show no signs of the disturbance going on within the kidney. It may be normal during the entire course of the disease, although, as a rule, thorough examination of a centrifugalized specimen will reveal the presence of bacteria; that is to say, a culture grown from the sediment obtained in the centrifuge will be positive. In severe infections of this kind, focal necrosis may occur and extend rapidly throughout the entire organ. Cases identical with, or similar to, this type were fully discussed in PROGRESSIVE MEDICINE ten years ago when Brewer's epoch-making paper was reviewed. At that time it was shown how the condition often developed as a complication of boils and infected wounds. Because of the virulence of the bacteria or the slight resistance of the patient, in some of these cases the changes in the kidney are immediately followed by a toxemia so profound that it may be confused with pneumonia or other severe infectious disease, with perforated gastric ulcer, fulminating appendicitis, or, in fact, with any acute rapidly progressive intra-abdominal lesion. Death may occur

¹ Journal of the Iowa State Medical Association, January, 1921.

within a few hours. It would seem that a previous traumatic or inflammatory lesion of the kidney predisposes it to the malevolent action of bacteria carried by the blood from a primary focus in some other part of the body. A point well brought out by Cabot is that this type of infection is the only one in which, within a day or two, a definite and tender mass can be palpated in the region of the kidney.

With regard to the treatment of cases of this kind, nothing of importance has developed since Brewer's paper was written ten years ago. Cabot naturally shares the opinion of all surgeons, that operation is indicated as soon as the diagnosis is made. He discusses the relative value of nephrectomy and nephrotomy, and, as might be expected from a surgeon of his experience, is inclined to resort to the former when there is the slightest doubt. From the bacteriological standpoint, it is interesting to note that Cabot has found several streptococcus infections confined to the glomeruli. As a rule, there was no change in the urine at any stage, although occasionally the bacteria could be isolated during the height of the attack.

Distinctly opposed to the pathological picture and symptom-complex above described, is the type produced by the colon-typhoid group of bacilli, which constitutes the majority of renal infections. The picture is that of a low grade infection of the kidney producing a cloudy swelling which rapidly clears up within a few days. The organisms pass through the kidney and find a resting place in the pelvis. The effect of the organism upon the functions of the kidneys is very striking and also very different from that caused by the coccus group. Whereas the latter, as above stated, is principally confined to the renal cortex, the former produce a diffuse inflammation throughout the secreting tissues of the organ. As a rule, the functional disturbance lasts only two or three days. In the more acute cases, restoration to the normal occurs promptly, but in those of a more sluggish type, the symptoms are protracted, and a great deal of time is necessary to effect a cure. In the chronic type the author found an infiltration of the renal pelvis with organisms living in the deeper layers. In the course of time considerable destruction of kidney substance may result, inasmuch as the infection may extend over the pelvis to the areas between the pyramids. Cabot states that the resulting scar tissue may eventually cause a decrease of 50 per cent in the volume of kidney substance.

Treatment of the bacillus type of infection, according to Cabot, consists in the liberal administration of urotropine, together with boric acid or benzoic acid, in order that the urine may be made distinctly acid. In certain cases, particularly those associated with pregnancy, the author has seen good results follow lavage and drainage of the renal pelvis. In discussing infections of pregnancy, he states that he is not able to account satisfactorily for the frequency with which they occur during the first period gestation. In this connection it is suggested that the so-called colon bacillus infection of newly married women, due to traumatism inflicted during the first attempts at intercourse, may be the underlying factor. Readers of this review may remember that this form of colon bacillus infection was fully discussed

a few years ago, at which time it was shown how prolonged or rough attempts at intercourse might so bruise the external genitalia as to lead to colon bacillus infection by contiguity. It is conceivable that a lower or even upper urinary infection of this type might be considered trivial until pregnancy occurs, but shortly thereafter, due to the pressure of the enlarged uterus and poor drainage, assume a more serious aspect.

A type of focal infection, differing from that producing suppurative nephritis described by Brewer in that it gives rise, as a rule, to a single abscess has recently been discussed by Hyman² and Walther.³ This form is likewise most frequently caused by the ordinary pyogenic organisms, particularly the staphylococcus, the only difference being that the lesions produced are discrete instead of diffuse. It may develop in a kidney which has previously been perfectly healthy and which has not been subject to traumatic injury.

Both authors state that, in the early stages of the infection, it is difficult to distinguish this form from the diffuse type in which the kidney is studded with small multiple abscesses associated with areas of necrosis. In describing the symptomatology, Hyman states that the sudden development of costovertebral pain, associated with chills and fever, during the course of any suppurative disease, such as ordinary furunculosis or a deeper suppurative lesion, should arouse suspicion of renal abscess. The symptoms, however, are not as severe as in the type of metastatic infection of the kidney described by Brewer. Frequently the urine will fail to give any indication of the nature of the trouble, for the reason that the suppuration in the kidney is well walled off, so that no pus escapes through the ureter. It is only in those cases in which the abscess opens into the pelvis that a pyuria will reveal the presence of suppuration high in the urinary tract. For the same reason, cystoscopy and ureteral catheterization may likewise give negative results. As a rule, the abscess is situated in the posterior part of the kidney, so that the pain will be referable to the lumbar region. In one case which came under Hyman's observation, however, the abscess was located in the anterior part of the organ, thus giving rise to symptoms partaking more of those produced by an acute intra-abdominal affection. Occasionally the pus may escape into the peri-renal tissue and set up a suppurative process there. From these considerations it is apparent that diagnosis is to be made rather from the symptoms of a general septic infection associated with signs of trouble in the lumbar or abdominal regions; and especially when these subjective and objective signs occur in conjunction with suppurative disease in other parts of the body. So far as treatment is concerned, there can be only one thing to do, and that is, to drain the abscess as soon as the diagnosis is made. Exposure of the kidney through the usual lumbar incision, with a free opening into the area of suppuration, followed by liberal drainage, will give a satisfactory result.

Three interesting cases are reported by Hyman. The first was that of a woman, aged twenty years, who had a crop of boils of several

² Urological and Cutaneous Review, November, 1920.

³ New Orleans Medical and Surgical Journal, March, 1921.

months' duration on the face and back. Three weeks before she came under Hyman's observation she had been as well as usual. She was suddenly seized with pain in the left side, developed a cough, and ran an irregular temperature for twelve days. A week before Hyman saw her, the pain in the side suddenly became worse, and in addition thereto, she suffered violently from pain in the left lumbar region. The fever reappeared and she had a severe chill. At this time she presented no symptoms referable to the urinary tract. The urine also was clear and was negative to culture tests. A cystoscopic examination failed to reveal anything abnormal. An *x*-ray examination of the thorax and subphrenic region was also negative. A diagnosis of perinephric abscess was made, and the patient was operated upon. Nothing was found in the perirenal tissue, but when the kidney was freed and lifted out of the wound, changes were at once noticed on its posterior surface. An incision into the diseased area liberated a considerable quantity of pus, from which a culture of staphylococcus was obtained. The patient made a rapid recovery, and three months after operation was in excellent health.

The second case was that of a woman, aged twenty-seven years. Three years before her present trouble she had suffered from pain in the upper third of the abdomen, radiating down the back and upward to the shoulders. She had also become slightly jaundiced. These symptoms disappeared and she remained well for two years, when she had a similar attack of twenty-four hours' duration. A diagnosis of gall-stones was made. At operation, however, nothing abnormal was found in the gall-bladder. A few months later a third attack occurred, there being on this occasion some localization of pain in the lumbar region. The patient ran a continued fever, lost flesh and suffered considerable impairment of general health. Examination revealed a large mass in the upper right quadrant of the abdomen, which was taken to be an enlarged kidney. *X*-ray examination was negative, as was likewise a cystoscopic examination. The urine, however, showed a few pus cells, a few red blood corpuscles and a trace of albumin. Elimination of indigo-carmine was good upon both sides, although it was somewhat better upon the left than upon the right. A culture of the urine revealed the presence of colon bacilli. An operation was decided upon, and the kidney was exposed through the usual lumbar incision. It was found much enlarged, and three abscesses were discovered on the anterior surface of its inferior pole. These were opened and an infarct on the lateral border of the kidney was also excised. The abscesses were drained and the capsule stripped off of the entire kidney. This patient also made an excellent recovery.

The third case was also in a woman, who had been ill six weeks at the time Hyman first saw her. She had suffered from boils in the axilla, one of which was present when she came under his observation. The general disturbance came on with violent pains in the left lumbar region, accompanied by chills and vomiting. The temperature rose to 104° F. In this case, as in the others, radiographic and cystoscopic examinations were negative, and the urine failed to show any abnormal

elements. A diagnosis of renal or perirenal suppuration was made and operation advised. A perinephric abscess, from which 50 cc of thick pus were evacuated, was found to communicate with a perforation in the superior portion of the renal capsule which led into an abscess in the substance of the kidney. The kidney itself was considerably congested and enlarged. The abscess was freely drained, and, as in the former case, the kidney was decapsulated. The outcome was as satisfactory as in the other two cases.

Wilbur Haines⁴ reports a case of pyelitis, especially interesting from the bacteriological standpoint in that it was caused by the *Bacillus pyocyaneus*. The author believes that this microorganism is the rarest of all those involving the renal pelvis. In his case the abrupt onset of the symptoms led him to believe that the infection was transmitted through the blood or through the lymph system.

Wilberforce and Harris⁵ have treated 2 cases of perinephric abscess secondary to furuncles. In the first case a correct diagnosis was made by the house physician. In the second case, however, the nature of the trouble remained obscure for weeks. The patient was suffering from septicemia, and gave a blood culture of *Staphylococcus albus*. The possibility of ulcerative endocarditis was considered, although no abnormal heart sounds were heard. Finally, a swelling was discovered over the right loin, whereupon the nature of the trouble became clear. The patient was operated upon and made a good recovery.

Some interesting experiments concerning *selective localization of streptococci in pyelonephritis* have been conducted by Bumpus and Meissner.⁶ Patients suffering with pyelonephritis and likewise affected with dental sepsis were studied, it being considered plausible that the latter condition may have supplied a focus from which destructive microorganisms were carried through the blood stream to the kidneys. Primarily cultures from the teeth of 6 patients so affected were injected intravenously into 27 rabbits, with the result that 89 per cent of the animals developed kidney lesions; 8 of them also had lesions in the bladder. It is noteworthy that morbid changes outside of the urinary tract were relatively slight in each case. The second series of animals were inoculated with streptococci isolated from the first group of animals. They likewise developed renal lesions. Then a third series subjected to inoculation with the organisms recovered from Groups I and II. In the third group the affinity of the attenuated organisms for the urinary tract was comparatively slight, although certain deviations from normal were found when the animals' kidneys were examined. It was evident that the affinity of these strains for the urinary organs was not accidental, because 208 other rabbits were inoculated in the same manner with streptococci from patients having diseases other than urinary infection and only 7 of them developed lesions in any part of the urinary tract. As a result of their experiments, the authors came to the conclusion that certain strains of streptococci, having a

⁴ *Urologic and Cutaneous Review*, December, 1920.

⁵ *The Lancet*, April 2, 1921.

⁶ *Archives of Internal Medicine*, March 15, 1921.

selective affinity for the kidneys and bladder, may localize in these organs and produce destructive changes, being carried to them by the blood stream from a primary lesion in some remote part of the body.

Renal Tuberculosis. In reporting 16 cases of renal tuberculosis treated by operation, Caspari⁷ discusses the general symptoms from which diagnosis should be made, and accords first place to cystoscopy and ureteral catheterization. To some of our readers it might seem unnecessary to mention these methods, but those surgeons who are consulted by patients having long suffered from vesical disturbances associated with a purulent urine will fully realize how many cases of renal tuberculosis go unrecognized, because of neglect to search for the source of the vesical disturbance.

Repeated examination of the purulent urine obtained by the ureteral catheter may be necessary to demonstrate the presence of Koch's bacillus, but even if that organism is not found, changes in the bladder wall, particularly around the ureteral orifice, will make it plain that the primary urinary lesion is higher up in the urinary tract. In addition to enabling one to procure urine from each kidney separately, the catheter may furnish reliable information concerning the condition of the ureter.

Animal inoculation should be tried in doubtful cases in which the tubercle bacillus is not easily demonstrated in the urinary sediment, but, even if it is negative, it does not rule out tuberculosis. In Caspari's 16 cases, the tubercle bacillus was found in 12. The author points out that in a certain percentage of cases palpation and deep pressure will not be of any value in making a diagnosis. It might be stated that the average base of renal tuberculosis, even in its early stages, can easily be diagnosticated by a resort to modern methods. Although attention has previously been called to their value and to the necessity of employing them in every suspicious case, I cannot refrain from again urging that they be advised by every reader of this review when he has a patient presenting symptoms at all suggestive of the disease. Early diagnosis means early operation and cure.

Eleven of Caspari's patients were women, and 5 were men. They ranged in age from eighteen to fifty-seven years. The right kidney was more frequently involved than the left. In 7 of the cases it seemed probable that the disease began in the cortex. In the remainder, all conditions pointed to a medullary origin. The kidneys showed cavities arranged around a central zone of tissue. In 2 cases cysts were found, 1 of which contained a stone. In approximately half of the number the renal pelvis was somewhat distended and showed unmistakable evidence of tuberculous lesions. The ureter was usually inflamed and thickened.

In common with a number of other recent writers upon the subject, Caspari dwells at some length upon the futility of expecting a spontaneous cure in this disease. In none of the kidneys which he removed was there the slightest evidence of a tendency toward spontaneous

⁷ Jour. d'Urologie, October, 1920.

healing. He strongly advocates nephrectomy at the earliest possible date after the diagnosis is made. In these days when so much bad ether has been placed upon the market, it is not surprising that the necessity of using a pure preparation should be mentioned. Possibly the author may have been forced to use some of the vile product that was put out during the war. He states that he has found a mixture of two parts chloroform and one part of ether very satisfactory.

In discussing the technic of nephrectomy for tuberculosis, Peacock⁸ states that he removes the ureter down as far as the pelvic brim and does not treat the stump at all. A rubber drainage tube is used. He has seen a number of cases of prolonged suppuration following nephrectomy which were due to lesions well down in the ureter.

A good point brought out in Peacock's paper is that operation should be followed by prolonged rest, sunlight, forced feeding, and in some cases by the administration of tuberculin. Changes of climate will also be beneficial. Naturally, the extent to which these measures will be required will vary with regard to the period and evolution of the disease when diagnosis is made and operation is performed, and also according to the presence or absence of tuberculous lesions in other parts of the body. A number of my patients have done well right here in Philadelphia after the kidney was removed. Very few of them have required any treatment whatsoever for lesions in the bladder. This is attributed to early diagnosis and early operation.

Leopold Casper⁹ discusses treatment of the bladder lesions secondary to renal tuberculosis. He states that improvement after nephrectomy is to be expected only when contractility of the detrusor fibers of the bladder is not impaired by connective-tissue degeneration. When shrinkage of the bladder wall occurs, treatment is practically futile, unless exclusion of the bladder is considered. Relief is to be obtained by the liberal administration of narcotics. The author still holds to Guyon's teaching that instillations are superior to irrigations in treating vesical tuberculosis. He does not favor instillations of carbolic acid and has also given up the use of lactic acid because of the extreme pain which the latter produces. Some relief may be obtained from instillations of oil with, or without, iodoform and guaiacol. The best results continue to be obtained by instillations of bichloride of mercury, 1 to 20,000, administered once or twice a week. The strength of the solution can gradually be increased until it reaches 1 to 2000. Another method which Casper has found of value is that of Hollaender, who administers potassium iodide internally and a few hours later instills calomel in oil into the bladder. The author, however, has modified Hollaender's method by adding 5 cc of guaiacol to each 100 cc of calomel suspension, which consists of 2 grams of calomel to 100 cc of sterile olive oil. Of this mixture, he instills 10 cc once or twice a week.

An interesting case of tuberculous ulcer of the bladder situated just below the right ureteral orifice is mentioned. It resisted all ordinary methods of treatment, but yielded to three treatments with the fulgurating needle.

⁸ Northwest Medicine, 1920, pp. 235.

⁹ Ztschr. f. Urologie, vol. 14, No. 7.

Occlusion of the ureter occurs in about 10 per cent of all cases of chronic renal tuberculosis. At least that is the percentage which Braasch¹⁰ gives as the result of his investigations on the subject. He states that in 9 out of every 10 cases a diagnosis can be made by clinical methods, by radiography, by cystoscopy. The usual subjective symptoms which point to occlusion are deep-seated lumbar-abdominal pain, and persistent frequency of micturition. These symptoms extend over a long period of time and are often associated with a gradual development of definite swelling easily palpable through the abdomen. The *x*-rays will give a deeper shadow than is normal because of caseation present in the kidney. Considerable importance is accorded to this sign in the case of patients having increased frequency and vagus pain in the abdomen or loin. Cystoscopic signs consist of a generalized inflammation with vesical contracture or of one or two inflamed or ulcerated areas around the ureteral orifice. Occasionally there is no inflammation of the bladder. Naturally color tests will render great service in this condition by showing that no dye escapes from one kidney.

Nephrectomy is the only form of treatment indicated, when the above-described symptoms are present. Ordinarily it has been an easy operation in the clinic. Some difficulty has occasionally been encountered in removing large pyonephroses or firmly adherent kidneys. In 53.6 per cent of the cases the ureter was found in such a condition that it seemed sufficient to ligate it and drop the stump back into the wound, the latter being closed without drainage. In the cases in which drainage was employed, a cure usually was obtained in one or two months. Only 1 patient died as the result of the operation; 84 per cent of the patients were completely cured.

The treatment of the ureter is a subject that formerly gave rise to considerable discussion, and various methods of dealing with it were practised by different surgeons. While there were many who thought it sufficient, even in cases where the ureter was very badly diseased, to remove as much of it as could be liberated through the nephrectomy incision, others, such as Kelly and Giordano, advocated its complete removal, in some cases going so far as to dissect away a portion of the bladder wall close to the ureteral orifice. It would seem that Kelly still favors ureterectomy in this class of cases, for in a recent paper by one of his assistants, Leo Brady,¹¹ the statement is made that nephro-ureterectomy seems to be the operation of choice when the patient's condition warrants a prolongation of the anesthesia. He does not state explicitly whether the diseased portion of the bladder wall is removed. A fair assumption, however, is that the procedure has been abandoned since more successful methods of treating persistent intravesical lesions have become known. It is significant that a comparison of the results in the series of cases which Brady analyzes, 77 in number, shows the final outcome to be equally as good when a portion of the ureter is left *in situ* as it is when that structure is entirely removed. The postoperative sinuses, however, healed more rapidly in those

¹⁰ Journal of the American Medical Association, November 13, 1920.

¹¹ Bulletin of the Johns Hopkins Hospital, January, 1921.

patients in whom the complete operation was done than in those in whom the diseased ureters were only partly removed and drained. In the former class the sinuses healed in an average time of five months, whereas an average of eleven months was required in the other cases.

As earlier diagnoses have been made and earlier operations performed, the question of treatment of the ureter has become of less importance. It would probably be safe to venture an opinion that in a fair majority of cases which come to operation at the present time, conditions are such that removal of a portion of the ureter through the nephrectomy incision is the method most commonly resorted to. Some still continue to use the injection of carbolic acid after dividing the ureter, according to the method advised by Mayo, and in cases in which it is known that there are lesions beyond the point of division, this procedure is to be recommended. A simpler technic consists in the application of two clamps, the division of the ureter with the thermocautery between them and then the ligation of the stump with catgut.

In a recent paper, D'Agata¹² presents the results of an examination which he made of a large number of tuberculous ureters. Without entering into a minute description of the changes which he found and the classification which he makes, the clinical application of his findings will be given. He has conclusively shown that in most cases in which the morbid changes are confined to the mucous and muscular layers of the ureter, spontaneous cure without any serious postoperative complications will be obtained by nephrectomy. In such cases he states that no treatment of the ureteral stump whatever is necessary. The ureter is doubly ligated, divided between the ligatures and dropped back into the wound. The second group of cases described by this investigator is comprised of those in which the external connective-tissue layer of the ureter was involved. In a certain percentage of cases the peri-ureteral tissue were also affected. Subjected to the same treatment as the cases in Group I, many patients of this class will also do well after a simple resection, although the author noted a tendency to the formation of fistulæ and occasionally a reflux of urine through the wound, the latter occurring when the juxta vesical portion of the duct was involved. It is interesting to note that D'Agata does not approve of complete ureterectomy with a resection of a portion of the vesical wall, even in this class of advanced cases. Those patients in whom this condition was present, without exception suffered from severe constitutional symptoms, and he did not feel that prolongation of the operation and the additional trauma incident to its performance was warranted.

Tumors of the Pelvis of the Kidney. Tumors derived from the epithelium of the renal pelvis are rare, those having their origin in the parenchyma of the kidney constituting a majority of the neoplasms affecting that organ. Of those developing from the epithelium of the pelvis, almost all are papillary in type, and, in the earlier stages of their evolution, are benign. Like papillary tumors elsewhere, however, as, for

¹² Archivio Italiano di Chirurgia, May, 1921.

instance, those in the bladder and in the mouth, they have a tendency to undergo malignant transformation. Once malignancy develops, these growths infiltrate the substance of the kidney, and may even perforate the cortex and extend to the perirenal tissue and thence to contiguous structures and organs.

P. E. MacCown¹³ reports the case of a woman, aged fifty-eight years, who was subjected to nephrectomy because of hematuria. On section, a newgrowth was found in the renal pelvis which, upon examination, proved to be a malignant papilloma. The author reports this case because of its rarity. He was able to find only 6 similar cases published in American literature. He also quotes Judd, who, in analyzing 207 renal tumors observed in the Mayo Clinic, found only 1 case of papilloma of the renal pelvis. From the statistics available, it would seem that men are more frequently affected than women, and that the left kidney is involved more frequently than the right. Of course, this incidence may be purely accidental, the number of cases on record being too small to warrant one in drawing conclusions. In 11 cases studied, metastasis had occurred.

A similar case has been recently reported by Alexis MacGlannan, of Baltimore.¹⁴ The patient was a man, aged sixty-seven years, who suffered from persistent hematuria, associated with general debility and dyspnea. The urinary hemorrhage had been present almost without intermission for two and a half years. The patient had also had attacks of pain referable to the lumbar and abdominal regions. Upon cystoscopic examination, the bladder was found to be undiseased, but blood was seen escaping from the left ureteral orifice. X-ray examination was negative. A neoplasm of the kidney was suspected, and the patient was subjected to a nephrectomy. Microscopic examination revealed the nature of the growth originating from the renal pelvis. It was reported to be a malignant papilloma becoming medullary carcinoma.

In discussing the *symptoms* of this form of neoplasm, MacGlannan states that the hematuria is almost always constant. At intervals profuse bleeding, associated with, or preceded by, colicky pains, is present. He states that pyelography will usually show some deformity of the renal pelvis.

Attention has also been called to the advantages of pyelography in diagnosis of neoplastic disease of the kidney of Colston.¹⁵ He reports 3 cases in which a diagnosis of essential hematuria had been made. Pyelography, however, showed filling defects in the pelvis and helped materially in establishing a correct diagnosis. The perusal of his paper is recommended to those interested in the subject.

In discussing malignant growths of the kidney, Pilcher¹⁶ lays stress upon some irritating factor, such as stone, inflammation, or renal stasis. In all the specimens examined, an area of inflammation was found, the

¹³ Journal of the American Medical Association, October 30, 1920.

¹⁴ Annals of Surgery, March, 1921.

¹⁵ The Journal of Urology, January, 1921.

¹⁶ Annals of Surgery, March, 1921.

growth apparently developing not in this area but rather around it, originating at its periphery. The effect of renal calculus in producing inflammation which might later give rise to malignancy was discussed in this review some years ago. Pilcher also insists upon the necessity for a cystoscopic examination in every case of unexplainable hematuria in order to determine the cause of the bleeding. He likewise accords some value to pyelography in those cases in which bleeding is found to be coming from the kidney.

Hyman,¹⁷ in reporting a series of 40 cases of renal tumor which were operated upon, gives a *resume* of 28 cases of hypernephromata, which constituted the majority of the group. Nephrectomy was performed in 20 of these cases, with 1 operative death. Most frequently the initial symptom was hematuria; then pain developed, and, finally, tumor formation became demonstrable. As the author states, the presence of this combination of symptoms generally signifies a condition far advanced. Before operating, he considers it advisable to radiograph all the bones, and the lungs as well, in order to exclude the presence of metastasis which, though present, may not be sufficiently developed to give rise to symptoms. He found that metastases were most frequent in the long bones, bones of the skull and in the lungs and liver, in the order named. A peculiar characteristic of this tumor, as noted by Hyman, is its tendency to break into the renal vein which, at operation or postmortem, is often found occluded by masses of tumor tissue. The author also reports 2 cases of adenocarcinoma which occurred in his series.

Hydronephrosis. In reporting 9 cases of dilatation of the renal pelvis F. C. Herrick,¹⁸ of Cleveland, Ohio, attempts a classification of the etiological factors and discusses the influence of trauma. He prefers the term "pyelectasis" in that it is etymologically correct, meaning a distention beginning in the pelvis and extending outward to the substance of the kidney.

In the opinion of the author, our present knowledge of the subject renders any classification of the etiological factors merely tentative. It does not seem sufficient to him to place them all under the heading of obstruction, inflammation and nervous disturbances, and, consequently, for the purposes of study, he presents the following classification, which proved of help to him in determining the relation of trauma to other factors.

I. Congenital.

Condition present at birth.

II. Acquired.

1. Predisposing factors.

Anatomical in character; partly congenital; quiescent; becoming active because of some acquired condition. Their degree and relation to active factors determine their potency.

¹⁷ Surgery, Gynecology and Obstetrics, March, 1921.

¹⁸ Transactions of the American Urological Association, 1920, vol 12.

- (a) Renal mobility—ligamentous attachments supporting and displacing renal fascia; cylindrical body; fatty capsule.
Muscular tone—body position; mobilizing force different from that affecting ureter.
- (b) Ureteral fixation—attachments to peritoneum; spermatic and ovarian veins. Free portion; angulation kinks; mobilizing force different from that affecting kidney.
- (c) Accessory structures—vessels or bands. Valves, mucous membrane folds. May result in no harm, but, with increased mobility from trauma or other cause, become obstructive factors.

2. Active factors:

- (a) Inflammatory—pyelitis; ureteritis; inflammatory stricture.
- (b) Traumatic—mobility; increased; hemorrhage; scar.
- (c) Neurological.

3. Direct factors:

- (a) Obstructive (mechanical) factors—stricture; scar formation; angulations (as in 1); pressure; stone.
- (b) Motor insufficiency or peristaltic failure.
- (c) Urinary secretion.

With regard to the effect of trauma in causing pyelectasis, the author considers it in relation to renal mobility, ureteral fixation, accessory structures, hemorrhage and scar formation.

The renal supports are divided into general, comprising body form, body position, muscle tone and peritoneal attachment; and local, including more or less well-defined and greatly variable ligamentous attachments to the liver, spleen, duodenum and pancreas, as well as the renal fascia and the fatty capsule. The importance of the cylindrical-shaped body is discussed. Statistics published by previous writers are reproduced.

Herrick's own investigations of renal mobility are of interest. In an examination of 48 cadavers he found the average mobility of the kidney within its supporting structures to be 4 cm. on the right side and 4.5 cm. on the left.

The cylindrical body form and the absence of a colic mesentery, together with progressive diminution in the volume of the fatty capsule, seemed to constitute predisposing conditions which render the kidney liable to displacement by repeated muscular strain. The continuation of such strain, rather than a single moderate trauma is probably responsible for displacement of the organ. It is conceivable, however, that a single injury of sufficient violence might so interfere with the integrity of the supporting structures as to displace the organ. In fact, some of the cases which Herrick reports impress me as being due to the latter cause.

The ureters of the 48 subjects above referred to were also examined. It was found that the most mobile portion is the upper 4 or 5 cm., from

the point where the ureter leaves the peritoneum to pass through the perirenal fat to the renal pelvis. This mobile portion of the ureter is subject to angulation above its fixed point by renal mobility, hemorrhage and scar formation. In exposing the ureter, the peritoneum was incised at the crossing of the iliac vessels. Here no fat was found between the ureter and peritoneum, the two being closely attached. Passing upward, the same condition existed until a point was reached within 1 cm. of the crossing of the spermatic vessels, where the ureter left the peritoneum and where fat was interposed between the two. With this most fixed point as an apex, a triangle was formed by the ureter, spermatic vessels and renal vein. On the right side the cava completes the mesial side of this triangle, and its base is the length of the renal vein.

In the traumatic type of pyelectasis to which special attention is given, the author enumerates the following stages of development. First, ureteral obstruction, periodic, partial or complete, due to renal mobility acquired from trauma or strain.

Back pressure against renal secretion followed by injury to secreting structures of the kidney.

Infection causing pyelonephritis and urethritis and still further damaging the secreting tissues of the kidneys.

Clinically, traumatic pyelectasis may be divided into two groups; one in which a demonstrable tumor develops within a few days or weeks after the injury, and another in which the evolution is slower, the patients going about their usual activities after the receipt of the injury for a variable period before any trouble is noticed.

Stricture of the Ureter. This subject in the male has been studied by Albert E. Goldstein,¹⁹ of Baltimore, who states that the diagnosis is not made from any one particular sign, symptom or finding, but from a combination of findings, which in the order of their importance he enumerates as follows:

1. History of suspicious renal or ureteral pain with, or without, urinary findings.

2. Determination of the capacity of the renal pelvis with salt solution or sterile water.

3. Ureterography and pyelography. This method is considered of the greatest importance. It usually results in demonstrating a constriction of the ureter with a dilatation above and also dilatation of the renal pelvis and calyces. Occasionally, a contracted renal pelvis may be observed.

4. Obstruction to the easy passage of the wax-tipped catheter, a sign which was positive in 87 per cent of the cases. The author refers to the resistance encountered as the "wax-bulb hang" and states that it is reliable only in the hands of expert operators. Slight resistance may not be detected by the novice.

In the series of cases studied by the author, the strictures were not situated at the anatomical narrowings of the ureter. Treatment con-

¹⁹ Urology and Cutaneous Review, January, 1921.

sists in gradual dilatation with the wax-bulb catheter at intervals of ten days or two weeks.

The work of Hunner,²⁰ of Baltimore, in clearing up certain vesical disturbances is well known, and his investigations of simple ulcer of the bladder received notice in this review a few years ago. Likewise mention was made of a class of cases in which vesical disturbances were apparently dependent upon foci of infection in remote parts of the body. In a more recent contribution, Hunner states he is now convinced that a great many of the obscure cases formerly considered as vesical neuroses may be correctly placed in one of the following classes:

1. Chronic urethritis with, or without, an accompanying trigonitis.
2. The simple ulcer group in which the small single or multiple ulcers of the mucosa are associated with a widespread chronic infiltration of all of the coats of the bladder wall.
3. A group in which the causative lesion is a chronic infiltration of the lower portion of the ureter producing narrowing of the latter structure and frequently causing symptoms particularly referable to the bladder. It is to the latter class of cases that the paper above referred to is devoted.

Further experience has fully convinced the author that focal infection is the cause of such infiltration and consequent narrowing of the lumen of the ureter. In his original communication on the subject, he expressed the opinion that disease in the tonsils was the primary focus. Further observations have apparently shown that infection in the bony sinuses of the skull may be responsible and also that the condition may result from trouble in the intestinal tract. To the latter, however, not much importance is attributed, although the author believes that infection of the static urine secondary to ureteral narrowing not infrequently follows inflammatory conditions in the bowels. It is evident that Hunner's cases occurred in women, because he speaks of the frequency with which the constriction is found in the broad ligament and of the possibility of detecting it by palpation. The list of case reports he appends to his paper also exclusively concern the female sex. The next most frequent site of stricture in his series of cases was in the region of the iliac lymph nodes. Because of these circumstances, it is thought that the original infection or toxin may first be arrested by the lymph nodes in those two regions and that the infection then settles in the ureteral walls, causing inflammation, infiltration and finally stricture.

The principal symptoms due to this form of ureteral constriction are often referable to the bladder, although, in addition to the vesical disturbances, there are certain associated symptoms which would lead one to suspect ureteral stricture. In the absence of circumstances leading to suspicion of the latter, the cause of the trouble is sought in the ureter only after exclusion of the more common causes of cystitis or vesical irritability.

As to differential diagnosis, tuberculosis, simple ulcer of the bladder,

²⁰ Journal of Urology, December, 1920.

chronic urethritis and trigonitis of gonorrhreal origin are to be excluded. In this connection it is noteworthy that the majority of cases of vesical irritability due to chronic urethritis and trigonitis are characterized by a negative urine analysis. Some of these may be due to focal infection as well as gonorrhea, and are to be differentiated from the latter by the absence of the history of acute infection and the absence of well-known signs about the external genitalia and the cervix. In some cases cystoscopic findings, of course, afford an additional means of differential diagnosis. Intermittency of symptoms is considered very suggestive. It may extend over a period of days, weeks or months, and the patient may have complete cessation of symptoms or only comparative comfort during these intervals.

Treatment consists of dilatation, which should not be practised oftener than once in ten days. In the densely infiltrated cases in which it is difficult to get through the contractions, it is better to allow two weeks for the subsidence of the edema and inflammation caused by treatment before using the dilator again. In bilateral cases only one ureter should be dilated at a time. Hunner always waits three or four days after dilating one ureter before he dilates the other. The urine in some of the ureteral cases is also clear. In such cases the cystoscopic findings and the possibility of palpating a thickened ureter will be helpful.

Perforation of the Ureter by a Calculus. A case of this kind, complicated by extravasation and sepsis, has been reported by James Berry.²¹ The patient was a young man, aged twenty-one years, admitted to the hospital for a large swelling in the right iliac fossa. During the previous nine weeks there had been a dull, aching pain on the right side of the abdomen. The day after his admission his temperature became higher, his pulse accelerated, and he also showed some general distention of the abdomen, with rigidity and tenderness to touch. At operation, the right kidney was found greatly enlarged, and there was some infiltration of the retroperitoneal tissues in the right iliac fossa. Palpation of this mass resulted in the detection of a small, hard body, which proved to be a calculus in the right ureter. At the brim of the pelvis a ragged hole about one-half inch in length was found. The ureter was drained. The patient did fairly well after the operation, but remained very septic; and although from $3\frac{1}{2}$ to $4\frac{1}{4}$ pints of urine were voided daily, he developed uremia and died twenty-four days after operation. At autopsy, a double pyelonephrosis was found. A large calculus was also removed from the lower end of the left ureter.

DISEASES OF THE BLADDER.

Tumors. At a recent meeting of the Philadelphia Genito-Urinary Society, B. A. Thomas reported 62 cases of bladder tumors which have come under his observation. Of this number, 30 were carcinomata, 25 papillomata, 6 polypi and 1 hemangioma. This report was also made at a meeting of the American Medical Association and has been

²¹ British Journal of Surgery, January, 1921.

published in full, together with the ideas which the author holds concerning treatment.²²

In 42 of these cases the only treatment which had been given was medical, apparently for the purpose of relieving such objective symptoms as hematuria and pyuria and lessening the frequent and difficult micturition from which the patients suffered. It is evident that no attempt was made to determine the source of the blood and pus and their causation. Nine patients had received some form of surgical treatment, which for the most part consisted in attempts to remove the growth through a suprapubic incision. Special stress is placed upon making a correct diagnosis of the nature of the tumor, for upon the latter the proper form of treatment depends. Thomas believes that the cystoscopic diagnosis far exceeds in value any made by other methods, although he accords a certain value to the cystogram and examination of a fragment of tissue excised from the growth. With regard to histopathological examination, I will take occasion to point out that a little piece of tissue bitten off with forceps may not show any malignant cells, although they will be found in other parts of the tumor.

Thomas's plan of treatment is outlined as follows: If the tumor is a polyp, hemangioma or papilloma, either single or multiple, the best treatment is fulguration or electrocoagulation through the cystoscope.

In selected cases of early malignant tumors, especially those involving the vesical orifice, in which complete resection of the tumor is impossible, it is desirable to open the bladder suprapubically and destroy the neoplasm by fulguration, and then to implant radium needles into the tumor bed.

In cases of malignant growths which are favorably situated and not too far advanced, the first thought should be extraperitoneal resection or combined extraperitoneal and intraperitoneal resection of the portion of the bladder occupied by the carcinoma, one or both ureters being implanted if necessary. This treatment should always be followed by intensive roentgen-ray cross-fire.

In cases beyond the hope of cure by radical surgical procedures, but in which something must be done to relieve symptoms, radium should be used after as much of the neoplasm as possible has been destroyed by fulguration. In one case in the series, Thomas successfully performed a total cystectomy.

Beer²³ describes a technic which he has devised for the purpose of avoiding tumor-cell implantation in cases in which it becomes necessary to operate through a suprapubic incision. Its essential points are as follows: With the patient in the Trendelenburg position, the bladder is opened by a suprapubic incision, the urachus is exposed and cut across and the peritoneum stripped from the posterior aspect of the bladder down to the trigone. This makes it possible to bring the bladder well out of the abdomen. The prevesical space is then packed with gauze and the bladder is opened, either through the anterior or

²² Journal of the American Medical Association, November 20, 1920.

²³ Annals of Surgery, January, 1921.

the posterior wall, according to the location of the tumor. Its interior is thoroughly dried with sponges, care being taken not to allow any of its contents to flow over the tissues. The tumor is completely destroyed with the actual cautery, and, if the bladder wall is infiltrated, a wide resection is also made with the cautery. Toothed forceps are not used. The edges of the vesical incision are seared and the bladder is filled with alcohol, after which it is allowed to slip back into the pelvis, so that the prevesical structures will also be flooded with the alcohol, which the author believes coagulates tumor cells. The cauterized margins of the vesical wound are first turned in by a catgut suture, which is supplemented by a second suture of chromic gut to bring the first suture line into better apposition. A rubber drainage tube is inserted in the bladder and the superficial tissues are drained with gauze.

In previous reviews the *value of radium in the treatment of vesical neoplasms* has been discussed. It is still too early to pass judgment on the method, but from what has been stated here before, together with observations since reported, it seems that it has its place in advanced cases. My belief is that it should not be used primarily in cases in which resection is feasible, being reserved for those which have passed beyond the limits of surgery or being employed as a supplement to surgery.

Further contributions to radium therapy have been made during the year. Among the more important of these is a paper by Kolischer,²⁴ of Chicago, whose work has been referred to before in this review, and one by Geraghty,²⁵ of Baltimore. Kolischer states that gold seems to be the best material for radium filters in bladder work. Because of the high atomic weight of the metal the filtering capsule does not have to be very thick.

As to the time of radium application, he distinguishes between primary application, raying following electrocoagulation of the tumor, and prophylactic raying secondary to excision of the tumor. The time of the primary introduction of radium into the bladder will depend upon the condition of the patient when he first comes under observation. If there is no appreciable cystitis, the radium may be used without any preliminary treatment, but, if there is marked inflammation, it is better to resort to preparatory treatment. The author has found that radium invariably gives rise to a reaction inside the bladder, and, if the cystitis is not cleared up previously to its use, there will be some difficulty in deciding how much of the irritation and subsequent changes in the mucous membrane are due to the cystitis and how much to the radium. If there is bleeding, the author has found it advantageous to wash out the bladder a number of times with 1 to 1000 solution of silver nitrate. If much infiltration is present in the bladder walls, a suprapubic cystotomy is performed. This relieves the strangury and also renders the tumor directly accessible to preliminary local treatment, which consists of electrocoagulation. The latter controls hemorrhage and lessens pain.

²⁴ American Journal of Surgery, December, 1920.

²⁵ Southern Medical Journal, 1920.

The capsule for use through an open wound as well as special instruments for introducing the radium through the urethra have been fully described in a previous review.

As the result of further experience, Kolischer states that he is inclined to believe that the curative success of radium therapy is based upon the production of defensive and protective ferments and not on any direct destructive action of the rays on the tumor cells. Furthermore, he states that if a tumor is amenable to radium treatment, it will respond promptly even if only part of it is exposed. Thus, it is apparent that if a few applications fail to bring about decided improvement, it is useless to continue with the treatment.

Geraghty recommends radium in early papillary carcinomata, applying it through a specially constructed cystoscope. Radiation is given for one hour, one to three times per week, according to the size of the tumor and the reaction produced. In this connection it is interesting to note that the author has frequently found it possible to distinguish a papillary carcinoma from a papilloma by means of the cystoscope, although he freely admits that differentiation between a malignant and a non-malignant papilloma cannot be made in that manner unless malignancy has advanced so far that the bladder wall has become infiltrated. Incidentally, it may be remarked that such a differentiation is not so easy, even in growths of the mouth, which are open to direct inspection. Geraghty also is of the opinion that all infiltrating growths should be resected if they are sufficiently localized to make radical resection feasible. After the removal of such tumors, he advises cystoscopy at an early date, so that any recurrence may promptly be subjected to irradiation. He has found that such recurrences frequently yield more promptly to radium than the original growth. He calls attention to the fact that the use of radium has not diminished the tendency of bladder tumors to recur, there having been about 30 per cent of recurrences in the series which he studied. He expressed the hope that an improved technic whereby more intensive radiation may safely be given may produce better results than have thus far been obtained.

Hyman²⁶ reports 3 cases of vesical carcinoma treated by excision. The first patient, a man, aged sixty-four years, came under observation four years before his case was reported, giving a history of intermittent attacks of hematuria of about eighteen months' duration. He had not suffered any pain, nor had he lost in weight. Upon cystoscopic examination, a neoplasm the size of a plum was found in the region of the right ureteral orifice. Sections were removed and found to be carcinomatous. The tumor was resected, and the ureter, a portion of which had to be removed, was implanted into the bladder. A cystoscopic examination made five months after the operation failed to reveal any signs of recurrence. The kidney on the side of the implanted ureter was also functioning in a normal manner. The patient has remained perfectly well during the four years which have elapsed.

²⁶ International Journal of Surgery.

The second patient, aged seventy-three years, gave a history of intermittent hematuria of one year's duration. Cystoscopic examination revealed two neoplasms, one a papilloma upon the right ureteral orifice and the other, considerably larger, further back on the bladder wall. Upon microscopic examination of sections taken from the latter it was found to be carcinomatous. Considerable induration was revealed upon rectal palpation, and the prognosis was not considered very favorable. However, a wide resection of the growths was made and at the time of the case report, six years later, the patient was free from recurrence and in good health.

The third patient died of uremia three years after operation. A cystoscopic examination, made three weeks before his death, failed to reveal any signs of recurrence.

Hyman emphasizes the following technical points in the radical operation for vesical carcinoma. (1) A large median incision from the umbilicus to the symphysis. (2) Free mobilization of the bladder, so that it can be brought out on the abdominal wall; all this is done extraperitoneally. (3) The bladder should not be opened until it is fully mobilized. Then it is important to pack off the wound very carefully, in order to avoid the danger of implants from the tumor. It is best to open the bladder after distending it with air, so there will be no leakage of infected contents. The bladder is opened with the cautery and the growth is thoroughly cauterized. Finally, after the tumor has been widely resected with the cautery, the edges of the bladder wound are again seared and the bladder and abdominal wound are flushed with 75 per cent alcohol. The edges of the bladder incision are inverted and closed with two layers of sutures, allowing space for a drainage tube.

A few years ago the subject of vesical neoplasms in aniline dye workers was discussed in this review. Recently another contribution to the subject has been made by M. Nassauer.²⁷ The author was manager of an organic chemical company for twenty years and reported 32 cases of bladder tumor among the employees and 6 other cases which were referred to him. After reviewing the literature, comprising a study of 61 cases, he discusses the chemical composition and physiological action of the different chemicals which have been held responsible for the development of malignant neoplasms and comes to the conclusion that aniline is the causative agent.

He states that men working at a distance from aniline may become affected by it, and consequently he concludes that the poison is inspired with the air. The time from the beginning of its action to the development of symptoms varies from twelve to twenty years, the purer the aniline vapors, the longer is the incubation period. At a certain degree of dilution, the vapors are taken up by the alveoli and carried into the circulation.

Although preventive measures have considerably reduced the incidence of vesical neoplasm in the workers, Nassauer believes that no one should be permitted to remain exposed to its vapors longer than three months.

²⁷ Frankfurt. Ztschr. f. Pathologie, 1920, vol. 23.

Another important contribution to the subject of malignant vesical tumors has been made by Judd and Sistrunk, of the Mayo Clinic.²⁸ From January, 1910, to January, 1919, 202 patients were admitted. The authors succeeded in keeping in touch with all of them except 18. In the entire group, the hospital mortality from all causes was 12.9 per cent. It is interesting to note that this total mortality percentage is somewhat higher than that which prevailed during the last few years of the nine-year period. The better results in the later cases are attributed to more careful selection of the patients, and more thorough preparatory treatment. The latter is conducted along the same lines as that used in preparing patients for prostatectomy. If there is residual urine and inflammation of the bladder, with involvement of the kidney due either to back pressure or ascending infection, the catheter is used either intermittently or continuously for some time before operation. It has been found that the immediate mortality rate can be kept well under 10 per cent by these measures. In discussing the ultimate results of operation, it is stated that they are about the same as those obtained after resection of the stomach and intestines for carcinoma. Twelve patients were operated upon in 1910 and 3 of the number were living and showed no sign of recurrence at the time the authors' paper was prepared. In 1 of these cases a complete cystectomy was performed, the ureters being fastened into the superficial tissues in the lumbar region on either side. In the other 2 cases transperitoneal resection of the bladder was performed.

The accompanying table indicates the number of patients who are living more than one year after operation. The authors state that, so far as can be determined, all were free from any trouble at the time they were examined.

Number living 10 years	2
Number living 9 years	2
Number living 8 years	2
Number living 7 years	3
Number living 6 years	5
Number living 5 years	12
Number living 4 years	3
Number living 3 years	10
Number living 2 years	13
Number living 1 year	12
Total	64

Most of the recurrences come in the first few months after operation. For this reason it is very important that the patient should be watched very closely during the second year, as well as the first year after operation. Statistics at the Mayo Clinic show that if a patient can survive the first year, his chances of remaining free from further trouble are very good. However, as a matter of precaution, all patients are followed closely during the second year.

The operations classified as resections usually involved removal of at least one-quarter of the bladder. The majority of them were per-

formed with the knife, but some were done with the cautery. The authors were surprised to find that a few patients upon whom the Percy cautery was used, because of the operator's inability to remove the tumor in its entirety, have remained well for six years. From this circumstance they infer that the Percy cautery has a wider field of application in this form of malignant disease than is generally accorded to it. In 34 of the 202 cases, the operations were merely exploratory. Some of these patients were treated afterward with *x*-rays and radium, and a number of them were benefited. Unfortunately, many of these cases occurred during the earlier years of the period, at a time when the intensive *x*-ray and radium treatment now employed was not in vogue; consequently, they do not constitute a fair criterion of the method. The authors express the encouraging opinion that radium applied directly to the tumor should have an effect as beneficial as it has in cases of carcinoma of the cervix.

DISEASES OF THE PROSTATE.

Hypertrophy. During the year papers concerning preparatory and postoperative treatment, as well as certain modifications of technic, have continued to appear in the medical press. Different surgeons have reported individual series of cases, for the most part simply serving to show their own experience rather than to add anything to the sum total of knowledge now generally possessed concerning the care of the patient before and after operation, as well as the performance of the operation.

Considerable attention has been given to determining the function of the kidneys prior to operation, and, from the literature available on this subject, it would seem that more attention is now being given to this matter by the average operator. In addition to the indigo-carmine and phenolsulphonephthalein tests, it is apparent that the blood-urea test is being more generally employed in English-speaking countries than was formerly the case. Thus, Dobson²⁹ states that estimation of the blood urea has proved of such service to him that he now has it carried out in every case of enlarged prostate before operation. If it is over 25, then preliminary treatment, consisting of bladder drainage and the administration of such drugs as are indicated in the individual case, is always resorted to before any operation whatever is done.

Even in the early stages of hypertrophy in which serious systemic complications are not clinically manifested, Brinkley³⁰ prefers to wait until the blood-urea nitrogen content falls to 30 or less before he operates. Zuckerkandl³¹ also attaches decided value to the functional renal tests. In discussing the factors which tend to make the operation dangerous, he places great stress upon the changes wrought in the renal circulation by the backing up of urine in the bladder.

²⁹ British Medical Journal, February 26, 1921.

³⁰ Virginia Medical Monthly, June, 1921.

³¹ Ztschr. f. Urologische Chirurgie, November 6, 1920.

Deaver and Herman³² have endeavored to determine the average mortality of prostatectomies, both suprapubic and perineal, as performed by the average surgeon throughout the country, in contradistinction to the mortality shown by the published statistics of surgeons of large experience, especially skilled in the performance of the respective operations. For this purpose an analysis of 2500 cases of prostatectomy was made, with the result that a death rate of 6.9 per cent was found in the suprapubic operations and a death rate of 10.9 per cent in the perineal operations. These comparative mortality rates are just opposite from that which has generally been accepted concerning the relative mortality of the two procedures. The high mortality after the perineal operation in this series is attributed to the circumstance that in a large number of instances the operation was performed by inexperienced operators. That the suprapubic operation is much safer for the occasional operator is a matter concerning which there can be little room for discussion. Further, discussing the mortality rate, the opinion is expressed that if cases in which the operation was done by more experienced men were eliminated, the average mortality would be between 20 and 30 per cent.

These figures are likewise corroborated by Gardner,³³ who, as a result of his investigations, states that he believes the average mortality for all operators to be 25 per cent.

In Deaver and Herman's paper it is shown that many factors play an important role in determining the mortality rate after prostatectomy. Thus, age, duration of the disease, involvement of the upper urinary organs, infection, and impairment of the circulatory system, must be taken into consideration. Age, *per se*, is considered to have really little influence, except that with advancing years the resisting powers of the vital organs naturally diminish; so the older the patient, the less likely he is to withstand the shock of operation and the evil effects of confinement in bed. With regard to prognosis, the authors believe that a patient can be assured that his chances for recovery are more than 90 per cent, and that the probabilities of continued life with entire comfort are more than 70 per cent. The end-results of 814 suprapubic operations show that 76 per cent of patients are reported as completely cured. In 372 perineal operations, the percentage was 70. In the series studied, there were also a number of partial prostatectomies recorded in which the results were excellent.

Complications of prostatectomy, as observed in the Mayo Clinic, were reported at a meeting of the Southern Minnesota Medical Association by V. C. Hunt.³⁴ The author states that the operative and postoperative complications have been materially lessened of late years, and he attributes this circumstance to the freer exposure of the bladder that has been routinely adopted in the Clinic. Since the open suprapubic operation has been performed to the exclusion of other methods, complications have really been reduced to a minimum. The

³² Archives of Surgery, March, 1921.

³³ Journal of the American Medical Association, December 11, 1920.

³⁴ Minnesota Medicine, August, 1921.

frequency of associated lesions, such as stone or diverticulum of the bladder, furnish an additional reason for the surgeon seeing his field of operation. The feeling in the Clinic now is that exposure is as important in the surgery of the prostate as in the surgery of other organs and regions of the body. The occasional accidental opening of the peritoneum, especially in cases in which a preliminary drainage has been done, is not considered at all serious, provided that it is recognized. Naturally trouble might be expected if infected urine were allowed to run out into the peritoneal cavity. Anatomical investigations have shown that the reflection of the peritoneum from the anterior abdominal wall on to the bladder is quite variable. This fact has evidently been brought to the attention of the surgeons of the Clinic, for Hunt states that occasionally it has been found low down near the bladder neck. In some cases in which the bladder was very much distended during an attack of acute retention or persistent chronic retention, and in which the fundus of the bladder was at the level of the umbilicus, the peritoneal reflection was not carried sufficiently high above the pubes to prevent the peritoneum from being wounded when the bladder was punctured or incised. Such cases, however, must be very rare.

Operative and postoperative hemorrhage have been responsible for a large number of the deaths following prostatectomy, and it is believed that the mortality from this source will be lessened when a wider exposure of the prostate is more generally adopted. Interrupted sutures have proved successful in controlling bleeding from the neck of the bladder. Hemorrhage from the capsule of the prostate is controlled by packing, or by the use of the Hagner bag, frequently alluded to in this review.

Vesical stone, associated with prostatic hypertrophy, often presents a definite complication. While the removal of the stone at the time of prostatectomy does not add to the difficulty of the operation, the presence of single or multiple stones and the associated cystitis which they produce, are considered to have a bad effect, not only upon the bladder itself, but upon the kidneys. A diverticulum, containing an ounce or more, is usually dealt with surgically and smaller ones in a markedly trabeculated bladder are, as a rule, left undisturbed.

Preliminary treatment has served to bring about amelioration of circulatory and pulmonary complications. Some patients suffering from these complications have been operated upon under spinal anesthesia. Postoperative pulmonary complications have rarely occurred. The patients are kept in bed only a short time, and it is due to this circumstance, so the author believes, that many old men, afflicted with chronic bronchitis and emphysema, have escaped acute congestion of the lungs.

Postoperative uremia is likewise becoming a rare complication, since preliminary drainage of the bladder has been employed. Secondary hemorrhage still occurs occasionally, and has frequently been caused by manipulation of the retained catheter. It is best controlled by removing the catheter and avoiding vesical irrigation. In some cases, it has been so severe as to make transfusion necessary.

Epididymitis has been observed after operation as well as before.

Its incidence is higher in patients who are subjected to intermittent or permanent drainage of the bladder by the urethral catheter before operation, and in patients in whom a urethral catheter is used after operation. The greatest care and cleanliness in introducing the catheter, in using all instruments under aseptic conditions, and isolating the patient with epididymitis, has greatly decreased the incidence of this complication. The complication was bilateral in nearly 25 per cent of patients. As a rule, it did not progress to suppuration, although in a few cases incision and drainage of the epididymis was required.

Persistent suppurative sinus is thought to be due, as a rule, to incomplete removal of the obstructing prostate; a transverse bar at the neck of the bladder; stricture of the prostatic urethra; a large diverticulum which has been overlooked, or the use of non-absorbable suture material. The formation of a transverse posterior bar between the bladder and the prostatic urethra which sometimes happens after enucleation of a large intra-urethral prostate, is now being guarded against in the Clinic by the employment of Walker's V-shaped incision described last year in this review.

General sepsis occasionally occurs when the prostatectomy has been performed in the presence of a great deal of local infection, and perhaps the most common cause of this very serious, if not fatal, complication is the indiscriminate use of the urethral catheter postoperatively in an attempt to close a suprapubic sinus. The prostatic capsule during the first two or three weeks after operation may be compared to an infected granulating surface anywhere else in the body. When any traumatism is inflicted upon this surface, as frequently happens when difficulty is encountered in passing the catheter, the infection may be carried into the blood stream and general sepsis follow.

Gardner,³⁵ of Buffalo, in recording a series of 109 prostatectomies which he performed in two stages, also takes occasion to discuss some of the postoperative complications, and remarks that many patients succumbed to hemorrhage in the days when continuous irrigation was practised. He also states that less bleeding has followed enucleation of the gland since the bladder has been drained and congestion of the prostate consequently relieved. In discussing measures for controlling bleeding immediately after the operation, he alludes to gauze packs and such devices as the Hagner or Pilcher bag, both of which have been described in this review.

In the author's series of cases there was only 1 postoperative death, which was due to embolism and occurred two weeks after operation. The average time required for the suprapubic wound to heal was thirty-four days.

Three cases of contraction of the internal meatus have recently been published by Andrew Fullerton.³⁶ He employs an incision similar to Walker's, although it does not remove as much tissue as is removed by Walker's V-shaped incision. Fullerton states that he merely divides

³⁵ Journal of the American Medical Association, December 11, 1920.

³⁶ British Medical Journal, February 26, 1921.

the vesicoprostatic septum with scissors down to the level of its union with the vesical work.

On several occasions reference has been made to the use of radium in treatment of malignant diseases of the prostate. In a recent paper, Condon,³⁷ of Omaha, describes his experience with the use of this substance in the treatment of benign enlargement of the gland. His rule is to drain the bladder by means of a urethral catheter, so as to increase the function of the kidneys; and when improvement of the patient's general condition has taken place, the bladder is opened under novocaine infiltration and any median enlargement is enucleated. While the latter procedure is being carried out, the patient is kept under nitrous oxide and oxygen; 50 mg. of radium are then placed in the posterior urethra, and in case of a very large prostate three needles of $8\frac{1}{2}$ mg. of radium are inserted into the substance of the gland. A ligature attached to the distal end of each is carried out of the wound through the drainage tube. These needles are filtered only through silver, and are removed at the end of twelve hours. It is stated that patients treated in this manner have a very mild convalescence. The drainage tube is removed after the fourth day and the patient allowed to get out of bed.

Carcinoma of the Prostate. In a thesis presented to the Graduate Faculty of the University of Minnesota, H. C. Bumpus³⁸ presents an analysis of 362 cases treated at the Mayo Clinic during the six years, from 1914 to 1920. The main object of his thesis is a careful study of the metastases which takes place in this affection and which the author believes are of more frequent occurrence than many statistics indicate them to be. Particular emphasis is placed upon the circumstance that metastatic involvement of other organs and structures of the body may be present when the prostate itself is only slightly enlarged, and that the disease in remote parts may remain dormant for a considerable length of time before giving rise to symptoms. A corollary to these findings in 362 cases, comprising the series which Bumpus studied, may be made with reference to the results of treatment. Thus, the author states that unless the presence of metastases is carefully ruled out by thorough *x*-ray examinations, and in those cases in which the *x*-ray is negative, by a careful neurological examination, no conclusion as to the value of any form of therapy can logically be drawn. Naturally nothing can be expected from a surgical operation in a case in which metastases are found in the femur or spine, for instance.

After describing the lymph system of the prostate, the author discusses metastases to the associated groups of nodes. Out of the 362 cases metastasis was found in 79, and in 37 of that number lymph nodes were involved. The latter figures give a percentage of 10.2 out of the total number of 362 cases in which glandular involvement was present. Attention is called to the low percentage of lymph-node metastasis noted clinically in comparison with the higher percentage reported by various writers who have published postmortem statistics. Bumpus

³⁷ Urological and Cutaneous Review, August, 1921.

³⁸ Surgery, Gynecology and Obstetrics, January, 1921.

expresses the opinion that if the iliac nodes could be examined satisfactorily, their early involvement would undoubtedly be proved. To such an involvement is attributed the pains often felt in the back, chest and abdomen, the occurrence of which may well be explained by pressure from metastatic growths upon the spinal nerve roots. In many such cases *x-ray* examination failed to show any involvement of the contiguous bony structures. The nerve-root pains, however, were exceedingly severe and were held to be due to pressure upon the nerves by enlarged nodes.

Bony metastasis was found in 41 of the patients who were *x-rayed*, giving a percentage of 51 out of the 79 patients in the total series who presented metastases. The pelvis, spine and femur were the parts most frequently affected. Out of 31 patients whose ribs were subjected to the rays, involvement was found in 6. The opinion is expressed that if the spine, pelvis and femurs are *x-rayed* as a matter of routine in all cases of prostatic disease in which malignancy is suspected, the number of cases of metastasis which will not be discovered will be negligible. Examination of the table which the author appends shows that practically one-third of all patients with carcinoma of the prostate have malignant invasion of the bones. In this connection the relation of bony metastasis to the efficacy of local treatment is again mentioned.

Metastasis to other parts may be enumerated as follows:

Cervical glands	6.3 per cent.
Spinal cord	6.3 "
Liver	1.2 "
Skin	1.2 "

The author states that metastasis to the lungs probably never occurs without involvement elsewhere.

Pathologically, two types of carcinomatous prostate are described. One corresponds to the well-known form of enlargement due to malignant disease, the condition present often being described as one of stony hardness. The contour of the gland is irregular, the hard nodules being discrete over certain areas, and apparently being fused in other parts, the former condition representing early involvement, the latter a later stage of the disease. As the morbid process advances, these different areas coalesce, so that the entire gland, together with the periprostatic tissues, eventually becomes converted into a hard, resistant malignant mass. This type is so well known that the author's rather minute gross and microscopic description of it will be omitted from this review.

In the other type which has been carefully studied by the pathologists at the Mayo Clinic, the prostate is so slightly enlarged and gives so few local symptoms that the lesions in it are often discovered only because of the symptoms produced by metastasis to other organs or structures. Even in the late stages of the disease the local growth does not become extensive. Bumpus states that the enlargement is generally uniform and the bosselated areas characteristic of the more usual type of prostatic carcinoma cannot be detected. There may be more localized areas presenting greater density than that shown by the gland as a whole,

but the so-called stony hardness which one is wont to associate with carcinoma is absent. Microscopic sections from such a prostate show that the cancer cells are scattered through a somewhat fibrous stroma and that they have hardly any tendency to glandular formation. The tumor resembles scirrhoue carcinoma of the mammary gland so closely that unless the origin of the specimen examined is known, it is likely to be mistaken for the former. This type is considered far more malignant than the other type, the latter also being the more common of the two.

It is interesting to note that in 11.5 per cent of all cases with metastasis, urinary symptoms were absent and that pain was absent in 25 per cent of all cases with metastasis. In closing his paper, Bumpus makes a most valuable suggestion to the effect that neuralgic and rheumatic pains in the lumbar and pelvic regions and in the thighs, in middle-aged or old men, unless easily traceable to other causes, should suggest the possibility of carcinoma of the prostate. As is well known, urinary symptoms in malignant disease of the prostate may long be absent and their association with the pains above referred to, is not a necessary accompaniment of carcinoma.

Sarcoma rarely affects the prostate. In reporting a case which recently came under their observation, Stern and Ritter³⁹ were able to collect only 35 cases from the literature, the first of which was reported by Stafford in 1839. In the text-books this form of neoplasm is generally dismissed with mention of its rarity and statement of the fact that it usually affects either very young children or very old men. It has generally been stated that the growth is either the small round-cell, or the spindle-cell, variety of sarcoma. At the time his text-book was published, Thomson Walker recorded only 4 cases of rhabdomyosarcoma. In the analysis made by Stern and Ritter, 11 different types were found in the 36 cases thus far recorded. In contradistinction to the metastases occurring in carcinoma of the prostate, those which develop in sarcoma usually affect remote organs, such as the lungs, liver and pancreas. It is interesting also to note that, despite the manner in which sarcoma rapidly fills up the pelvis, the lymph nodes of the groin and those in the iliac region enjoy a relative immunity. So, too, metastases to the bones has not been considered frequent. It would seem that diagnosis of this neoplasm has not been made very often during the early stages. Years ago I remember hearing Casper state that the condition usually remained unrecognized until the pelvis had been completely filled by the rapidly-growing tumor. One of the characteristics about this neoplasm is the rapidity with which it increases in size. Stern and Ritter found that it may vary greatly in consistency, being so soft that it apparently is almost fluctuating or so hard that it may resemble a fibroma or even a chondroma.

Naturally, the prognosis is very unfavorable. Possibly radium may offer more to the patient than surgery. The authors mention the case of Granville McGowan, whose patient was apparently cured, but died four years later of malignant diseases of the liver.

³⁹ American Journal of Surgery, August, 1921.

Their own patient was a man, aged forty-five years, who first came under observation November 6, 1920. For two years he had been troubled with frequency of urination, both diurnal and nocturnal, and for one year he had suffered from strangury. A week prior to the time the authors saw him, urination had been painful. There was nothing in his family history or in his past personal history which bore any relation to the present trouble. The urine was negative. A rectal examination showed the prostate to be markedly enlarged, firm and regular. The enlargement was confined to the left lobe. From the consistency of the enlargement, malignancy was suspected. An *x*-ray picture was then taken, with the bladder inflated with air. This showed a marked enlargement of the left prostatic lobe, the catheter being deviated to the right, making a peculiar curve through the prostatic urethra. It was impossible to pass a cystoscope into this patient's bladder. Following the attempt he had a sharp hemorrhage which, however, subsided the following day.

Before resorting to operation, two prophylactic *x*-ray treatments were administered at intervals of forty-eight hours. The day following the second exposure the strangury became worse, and a considerable quantity of blood was passed through the urethra. The patient was put to bed and a retention catheter inserted. After a few days the bleeding subsided, a suprapubic cystotomy was performed, and a tumor about the size of a hen's egg was found in the left lobe of the prostate. It was easily enucleated. The bladder was normal. There was some bleeding from the prostatic cavity after removal of the growth but it was easily controlled by packing. Microscopic examination of the growth proved it to be a spindle-cell sarcoma. The operation was supplemented by radium treatment, which gave the patient considerable relief from the vesical irritation. The latter returned, however, after about two weeks. On February 7, 1921, about six weeks after the operation, the patient died. Postmortem examination showed that the neoplasm had involved the entire vesical mucosa and that it had extended on to the abdominal wall as high as the umbilicus. It had also grown backward toward the rectum to which it had become fastened. In discussing this case, the authors state that had a positive diagnosis of the nature of this neoplasm been made before operation, they would have treated the patient by *x*-rays and radium applied through a small suprapubic opening.

Cyst of the Prostate. A man, aged forty-two years, who consulted Goeller⁴⁰ for relief from nocturnal frequency of urination from which he had suffered for ten years, was found upon rectal examination to have a soft swelling of considerable size extending from the midline toward the left lateral wall of the pelvis. As far as could be determined, it was confined to his prostate. Cystoscopic examination failed to reveal anything abnormal except a slight enlargement at the vesical orifice. The mass was diagnosed as a cyst, and was aspirated through the rectum. Six cubic centimeters of a thin, light-brown fluid

were evacuated. A piece of the cyst wall was also removed and submitted to the pathologist for examination. It was found to consist of fibromuscular tissue. One section contained a rather large amyloid concretion, suggesting a certain amount of stasis in the prostate.

The fluid was also examined. It was described as a thin, slightly albuminous, opaque, rusty-colored material, in which there were no pus cells, no tumor cells, but a very few red blood cells. It contained many collections of lipoid granules and a few fat crystals. From these findings and the histological report, the author classed the cyst as a retention cyst.

The patient was followed for a considerable time and showed no signs of any recurrence. He stated that within a few days after the operation the frequency of micturition stopped.

DISEASES OF THE URETHRA.

Non-specific Urethritis. Non-specific forms of urethritis are discussed by Wolbarst,⁴¹ of New York, who points out the necessity of differentiating them from the specific form for which patients usually seek treatment. He calls attention to the fact that non-specific inflammations are often not amenable to the therapeutic measures generally employed in the treatment of gonococcus inflammation, and also refers to the social and economic importance of differentiating them from the latter. It is evident that those practitioners who make a routine bacteriological examination of the secretion in every case will not fall into errors in diagnosis in this class of cases, but those who assume that every urethral discharge is gonorrhreal, will occasionally make a mistake; hence the importance of examining a smear from every patient at the time of his first visit.

Wolbarst considers the micrococcus catarrhalis and the colon bacillus to be the most frequent causes of non-specific varieties of urethritis. In dealing with the former, we are confronted by the extreme difficulty of distinguishing it from the gonococcus, since it bears so close to resemblance that it can be differentiated only by culture methods. This form of infection was fully discussed in PROGRESSIVE MEDICINE several years ago, and it was shown then that local applications useful in gonococcus infections are apt to aggravate, instead of relieve, the symptoms. With regard to the colon bacillus, the inflammation which it produces resembles the catarrhal infections. The microscope, however, fails to show any diplococci, but cultures made from the discharge will readily reveal its nature. According to the author, other non-specific types are rarely met with. The greater part of them are due to ordinary pyogenic organisms.

Some space is devoted to the urethritis which accompanies the evolution of a meatal or urethral chancre. This condition is rare and it is not surprising that the general practitioner often treats it as a gonorrhreal urethritis until the secondaries make their appearance. The

⁴¹ New York Medical Journal, October 9, 1920.

swelling of the meatus, a considerable amount of discharge and a first urine laden with urethral débris serve to explain his mistake. Here again, it is well to call attention to the importance of bacteriological examination of the secretion. Wolbarst describes certain characteristics of the meatus which he considers almost pathognomonic of chancre. He states that the lips are rather whitish and shiny, that they stand apart instead of coming together, and that when felt between the fingers the typical induration of an initial lesion can be detected. These are all excellent points for the doctor to remember.

In an interesting paper on the diagnosis of gonococcus infection by laboratory methods, R. A. Kilduffe⁴² shows the importance of certain details in the preparation of the specimen and also in the staining methods. Both seem to be of sufficient value to warrant reproduction here, especially since laboratory methods are so much more generally used than they were a few years ago. Greater dissemination of knowledge among the laity concerning the persistence of gonorrhea has resulted in greater efforts on the part of patients to assure themselves that they are cured. It is not at all uncommon, as Kilduffe states, for patients who are apparently well to apply for further examination. Likewise, many with chronic persistent discharges will ask to have frequent bacteriological examinations made as the treatment progresses.

With regard to preparation of the specimen, Kilduffe lays down the following rules:

The patient should not void for at least an hour previous to having the specimen taken, thus avoiding flushing out of the canal.

The smear should be made from the urethra. This is of particular importance in the female, for nothing is of less diagnostic value, except in vulvo-vaginitis of children, than a hastily taken smear from the vagina. In the adult female, additional smears should be taken from the cervix and so labelled.

The smear should not be too thick, as the difference between Gram-negative and Gram-positive organisms may be a matter of some difficulty to determine because the thickness of the smear protects them from the action of the reagents.

The smear should be taken in duplicate upon microscopic slides or cover glasses, which should be allowed to dry spontaneously before being placed in contact. Nothing is more unsatisfactory than slides which have been placed together while moist and have adhered upon drying so that they must be pried apart for staining. (In this connection it may be suggested that a satisfactory smear can be made by placing two cover glasses together, upon one of which a drop of secretion has been placed and then drawing them apart so that the secretion may be thinly and evenly distributed over the two. They are then allowed to dry in the air.)

Douches, injections, washings and the like should not be used before the specimen is taken.

The following technic is recommended for staining the gonococcus:

⁴² American Journal of the Medical Sciences, April, 1921.

Fix the dried film by passage through the flame; cover with gentian violet solution for one minute; wash off the gentian violet with Gram's iodine solution and replace with another fresh portion of iodine solution, which is allowed to act for one minute; wash off the iodine solution with alcohol, 95 per cent to absolute, and flood the film with alcohol; tilt the slide to allow the alcohol to flow back and forth until no more violet color is given off; restain thirty seconds with a weak watery solution of Bismarck brown, eosin (0.5 to 1 per cent), or a very dilute solution of carbol-fuchsin (2 drops to test-tube full of water); wash in water, blot and mount.

The criteria for the recognition of the gonococcus in the stained smear are as follows: It must be Gram-negative. It must be a diplococcus and typical bean- or kidney-shaped forms must be demonstrated in some area of the smear. Careful search should also demonstrate some intracellular forms. It must be remembered, however, that in acute cases the majority of the gonococci are often extracellular.

The author lays considerable stress upon the exact technic of Gram staining which he describes in detail. (1) The gentian violet solution made with aniline water must be relatively fresh; even when other solutions of more stable character are made use of, the stain should be frequently tested with known Gram-positive organisms. (2) The film must not be too thick, as decolorization may be difficult and unsatisfactory. (3) The films should be allowed to dry spontaneously and care should be taken to avoid overheating when fixing, as atypical staining may occur. (4) The iodine solution should be stronger than that in the original formula, the water being reduced from 300 cc to 100 cc. (5) The alcohol used for decolorizing should not be weaker than 95 per cent and should not be allowed to act for too long a time, as Gram-positive organisms resist its action only for a short time and exposure of the film to alcohol for longer than two or three minutes may give confusing results. (6) The restaining must be in water solution. It must not be too strong nor allowed to act for too long a time, as it may replace the gentian violet and give false Gram-negative pictures.

The difficulty in diagnosing chronic gonorrhreal infections by culture methods and the uncertainty of the complement-fixation test led Robinson and Meader⁴³ to try a precipitin test similar to that used in pneumococcus and meningococcus infections. For this purpose they tried reaction of immune rabbit serum and the autolysate of gonococcus cultures. Rabbits were given intravenous injections of single strains of gonococci at seven-day intervals, the dosage being somewhat increased upon each occasion. Usually five or six injections were sufficient to produce a serum giving a marked precipitin reaction in a dilution of 1 in 20. The autolysate was prepared by washing off the growth of gonococci on rabbit-blood agar in 5 cc of normal saline solution and allowing it to stand in an incubator for six hours. This suspension was centrifuged and the supernatant fluid superposed on an equal quantity of the immune serum. The tubes were then placed in a

⁴³ Journal of Urology, December, 1920.

water bath at 37° C. for one hour. After cooling, the results were read. A positive reaction was indicated by a cloudy white ring at the junction of serum and autolysate. All strains of gonococci gave a positive reaction with immune serum, and no differences were noted between homologous and heterologous autolysates; so there appeared to be no strain specificity.

For purposes of diagnosis, the autolysate is obtained by moistening a sterile swab in the material to be tested and incubated in 2 cc of normal saline solution for six hours. The swab is then removed and the infusion centrifuged. If, as occasionally happens, the fluid remains opalescent in spite of centrifugalization, a correct reading can be obtained by comparing the density of the precipitated ring with that of a control tube containing normal rabbit serum.

The procedure is described as follows: For each specimen to be examined 0.25 cc of diluted clear serum from 2 immune and 1 normal rabbit are placed in test-tubes. The clear extract of the specimen is superposed on an equal amount of serum, the tubes are incubated for one hour at 37° C. and allowed to cool. Two immune sera are used in order to duplicate results and the serum from a normal rabbit is used as control.

As a result of their investigations, the authors conclude that a positive precipitin test is obtained in all cases where the gonococcus is found in the discharge, and that it is also obtained in many cases where the history and symptoms point to gonorrhreal infection, but in which the gonococci cannot be found in the secretion. They also expressed the opinion that the test is valuable in the diagnosis of vaginal and other specimens where the microscopic demonstration of gonococci is difficult or impossible. Naturally, whatever value this test may ultimately prove to possess, it will be resorted to by the clinician only in the obscure cases such as mentioned in Classes 2 and 3.

The authors also found that the meningococcus gave a positive reaction with gonococcus immune serum when concentrated pure culture autolysate was used, but the gonococcus control autolysate continued to give a positive reaction for a considerable number of dilutions after the reaction with the meningococcus had become negative. It is interesting to note that the Micrococcus catarrhalis gave a negative reaction.

The differences in toxicity of different strains of gonococci have been investigated by Jotten.⁴⁴ By means of the methods of agglutination and complement-fixation test used to differentiate the several forms of meningococcus, he was able to separate four groups of gonococci which he terms A, B, C and D. The groups A and B were more toxic for mice than groups C and D and the non-classified gonococci. They were likewise found to possess greater resistance to the opsonic bacteriotoxic and bactericidal action of normal serum. It was also found that these groups were associated with severe and complicated cases of gonorrhea in the human subject. No morphological or cultural

⁴⁴ Muenchener Medizinische Wochenschrift, 1920.

differences between the more toxic and less toxic forms were discovered. Jotten states that these results show the importance of using autogenous vaccines and explain the unsatisfactory results obtained by stock vaccines which often do not contain the strain corresponding to that in the patient.

A number of cases of severe constitutional complications of gonorrhea have come to my notice during the perusal of last year's literature.

Ribierre and Leobardy⁴⁵ reported a case of septicemia in which the gonococcus was found in the blood and also in the sputum. It developed during the fifth week of an attack of urethritis. The patient developed a severe cough and the expectorate was blood-stained. Signs of consolidation of the lung appeared over the right apex. The examination of the sputum was negative for tubercle bacilli and pneumococci, but was positive for Gram-negative diplococci. A Gram-negative diplococcus was also obtained by culture from a specimen of blood taken during the height of the fever.

Widall and May⁴⁶ treated a patient in whom marked icterus developed during the course of a gonorrhreal septicemia. Their patient recovered after five intravenous injections of antigenococcus serum, in that respect apparently constituting an exception to the rule, for in all the cases which the authors were able to collect from the literature, the patients died.

A case of malignant gonorrhreal endocarditis in a female child, aged twenty-three months, is reported by H. L. Dwyer.⁴⁷ The symptoms included a vaginal discharge, pain and swelling of the left ankle and wrist, jaundice, abdominal distention and a temperature of 104° F. The cardiac signs consisted of a rapid and irregular pulse and a soft systolic murmur at the apex. Microscopic examination of the vaginal discharge revealed the presence of Gram-negative intracellular diplococci. The same organisms were also recovered from a superficial abscess over the lumbo-sacral region. Blood culture gave a growth of the same organism. At autopsy, cauliflower vegetations were found on the mitral valve and from these growths the same Gram-negative diplococcus was likewise recovered. This case is of interest because of the rarity of gonococcal endocarditis in children.

In discussing cardiac gonococcus infection, Jagic and Schiffner⁴⁸ express the opinion that this complication occurs more frequently than is generally supposed, and that if more attention were given to the heart in cases of generalized gonorrhreal infection, more instances of involvement would be discovered. They believe this is especially true of mild forms of myocarditis. They also think that gonorrhea may account for some cases of myocarditis in which no history of the more common causative factors can be elicited. They distinguish two forms, septic myocarditis producing multiple abscesses in the myocardium, and generally resulting in pyemia, and a simple infective myocarditis. They call attention to the importance of distinguishing the latter form from functional cardiac symptoms of a vasomotor nature occurring during

⁴⁵ Medical Science, June, 1920.

⁴⁷ Ibid.

⁴⁶ Ibid.

⁴⁸ Ibid.

a period of pyrexia. Clinically, simple gonorrhreal myocarditis is characterized by cardiac weakness, arrhythmia, dilatation of the left ventricle and mitral insufficiency. It may end in resolution or result in fibrosis. Two cases are reported, both in women, one complicating gonorrhreal urethritis and arthritis, the other, gonorrhreal salpingitis. In both cases the cardiac signs appeared after the fever and acute local symptoms had subsided, and in both there were signs of myocarditis with dilatation of the right ventricle.

Mercurochrome. Another report on mercurochrome has come from the Brady Urological Institute, Young, White and Swartz⁴⁹ having published conclusions derived from further experience with this substance. They state that in spite of the high test-tube germicidal action of mercurochrome the results obtained by its local use in acute gonorrhrea have not been superior to those obtained by the intelligent use of argyrol or acriflavine. It is in chronic infections of the urethra, prostate and vesicles that its superiority has been proved. Excellent results have been obtained in many cases of chronic cystitis which were rebellious to other drugs. Its penetrating power is extraordinary, and the authors state that it may be found in the prostatic secretion several days after it has been instilled into the posterior urethra. In last year's review the opinion was expressed that this chemical constitutes a valuable addition to the armamentarium of the genito-urinary surgeon. All evidence accumulated since that time confirms that opinion. One drawback to its use is the way in which it stains everything with which it comes in contact. The authors have had considerable further experience with it as an application to chancroids and open chancroidal buboes, and have found it a valuable dressing for those lesions.

Ulceration of the Meatus in the Circumcised Infant. Edema of the meatus following circumcision is a condition frequently observed both in children and in adults, and, although temporarily annoying, it usually subsides within a few days. In a recent contribution under the above title, J. Brennemann⁵⁰ describes a class of cases which he has observed only in young children in which the inflammatory changes at the urinary outlet progress to ulceration. He states that it is always accompanied by pain upon urination, often by distention of the bladder, and occasionally by hemorrhage. The author attributes the ulceration to the action of ammoniacal urine, which is brought into contact with the meatus by the wet diaper. In 25 cases which have recently come under observation, this was considered to be the sole cause.

From what is known concerning similar ulcerations on parts constantly in contact with the diaper, it is suggested that the ulceration is preceded by a vesicle which breaks and leaves a raw surface upon which ulceration develops. Usually, it becomes encrusted and the area of inflammation extends to the adjacent surface of the glans penis. In some cases contraction of the urethral orifice occurs, although this is not permanent. The age incidence is of special interest, the condition

⁴⁹ Journal of American Medical Association, July 9, 1921.

⁵⁰ American Journal of the Diseases of Children, January, 1921.

being very rare during the first six months of life and most frequent during the second year. No cases were observed after the third year.

In discussing the etiology of the "ammoniacal diaper," as he terms it, the author states that nothing definite has thus far been learned. In the case of a child which is usually healthy, except for constipation, a very strong odor of ammonia is noticed about the wet diaper when it is changed. The fumes are distinctly irritating to the nostrils and even to the eyes, although many children may be affected with the condition for weeks or even months without presenting any break in the skin with which the diaper comes in contact. Usually, however, it gives rise to a marked erythema associated later with desquamation. In some cases the irritation may progress to vesicle formation and then to ulceration.

MISCELLANEOUS.

Sex-gland Implantation. Of late, considerable attention has been aroused by publications in the lay press concerning the rejuvenating effect of implantation of interstitial glands, a term which apparently is considered by laymen and many medical men as well, to refer to the testicles. That idea is partly correct, inasmuch as the organs implanted are testicles. The term "interstitial gland," however, correctly used and first introduced by Bouin and Ancel, refers to certain cells contained within the testicle itself which have a vivifying function in contradistinction to the spermatogenetic function possessed by other testicular cells. In other words, it refers to that part of the testicle which forms an internal secretion comparable in its effect to the secretion of glandular structures, such as thyroid and suprarenal, for example, although exerting a totally different effect from the secretions of the latter organs, having to do especially with the sexual characteristics.

A year ago we heard stories about the testicles of an anthropoid ape having been implanted into the tissues of an old man who sought to regain his youth by the operation, and within the last few weeks the daily papers published an account of another octogenarian who died on the day appointed for him to give a lecture setting forth the effects of a similar procedure to which he had submitted a few weeks before. While such cases are amusing, they in no wise detract from the really scientific interest which attaches to this and similar procedures.

There is really nothing new or wonderful about the much-talked-of interstitial gland implantation. Nearly seventy-five years ago Berthold experimented upon young male fowl and found that it was feasible to remove the testicles from their normal location, implant one into the abdominal cavity and still have the fowl maintain its natural masculine characteristics. Numerous other similar experiments have been conducted and it has long been known by biologists that young capons can be made to crow and develop combativeness by implanting testicles from other male fowl into their tissues. In 36 out of 46 cases, Steinach succeeded in transplanting the testicles of young rats, the animals maintaining their usual male characteristics. It is not surprising that some one should have attempted similar procedures in man. Certainly

the importance of preserving a fragment of ovary in mutilating operations upon the female pelvic organs has been fully recognized, and autoplasic grafting of an ovary has been performed often enough so that it is no longer a surgical curiosity. While in Paris, in 1909, I remember seeing Tuffier do such an operation. He also mentioned certain heteroplastic operations which he had performed and remarked that in one such case an ovary which he had implanted into the abdominal wall underwent cystic degeneration and had to be removed. In 1913, Voronoff implanted a monkey's thyroid into the neck of a boy affected with myxedema. The result was so satisfactory that this cretinoid youth, four years later, in 1917, passed the examination for military service and was inducted into the French Army. In 1912, Hammond and Sutton reported a case in which a testicle taken from a man who died of hemorrhage resulting from rupture of the liver was implanted a few hours later into the scrotum of a patient from whom a sarcomatous testicle was removed. So far as we have been able to determine, this was the first case of deliberate transplantation in man. Lespinasse, of Chicago, also had occasion to implant a normal testicle in the case of a man, aged thirty-eight years, who had lost both testicles. A few days after the operation the patient had a strong erection associated with sexual desire.

Another Chicago surgeon, Frank G. Lydston, has become closely identified with this subject, and his monograph published about four years ago contained a full summary of all information concerning it which was at that time available. In a more recent contribution, Lydston⁵¹ published the opinions which he now holds as the result of further observations and study. In 1 of the cases referred to in the later contribution, five years have elapsed since the implantation was made, and Lydston states that the benefit which follows the procedure has been maintained. There are also several other cases in which from two to four years have passed and in which the benefit likewise continues. In 2 of these, the author states that the implanted glands still survive. These results in man are quite in keeping with those performed upon the lower animals and really present nothing marvelous. As Lydston states, it is simply a matter of body tissues being able to retain the graft and the graft being able to continue the secretion of its hormones. Passing from gallinaceous birds, frogs and rats, it is but a short step to higher animals, such as goats, sheep and anthropoid apes. In 1918, Voronoff reported his experiments upon the latter class of animals to the French Congress of Surgery and in his recent monograph⁵² he shows a number of pictures of castrated goats and rams before and after the implantation operation had been performed.

Lichenstern⁵³ has likewise reported his experience in man. His first patient, aged twenty-nine years, had had both testicles shot away.

⁵¹ American Journal of Surgery, March, 1920.

⁵² Vivre. Etude des moyens de relever l'énergie vitale et de prolonger la vie, Grasset, Paris, 1920.

⁵³ Jahresreise f. ärztliche Fortbildung, April, 1920. Ztschr. f. urolog. Chir., June 13, 1921.

Six weeks after the implantation operation, he was enjoying the best of physical and mental health and was able to copulate. This patient was followed for five years and it was found that the effect of the operation had been maintained throughout that period. Two other similar cases were reported by the author, one being that of a man, aged twenty-eight years, in whom the implant was made three months after injury, and the other the case of a man, aged thirty-two years, in whom the implant was not made for ten years after he had lost both testicles. The author states that in the latter case the patient presented all of the characteristics of the eunuch, but that he was restored by the transplantation operation. Another case is mentioned in which the procedure was successfully performed upon a man, aged thirty years, who had lost both testicles on account of tuberculosis. This was reported by Kreuter, and is mentioned in Lichtenstern's article. After the removal of the second testicle, this patient's sexual desire had completely disappeared. Three weeks after the implant was made, he had an erection accompanied by sexual desire. He had not had intercourse, however, although he seemed to be getting stronger sexually all the time.

A year ago Stanley and Kelker,⁵⁴ of St Quentin's Prison, California, reported 10 cases in which they transplanted the testicle of recently executed criminals into other criminals who were mentally and physically defective. Their first operation was done in August, 1918. In 5 cases only one testicle was implanted in the scrotum, while in the remaining 6, double transplantation was performed. They state that the results from single transplantation are apparently as satisfactory as those obtained when two organs are used. In 7 cases the organs were grafted instead of being merely imbedded in the scrotal tissue and the authors express the opinion that the former method is preferable. A beneficial effect following this procedure, although the authors are unable to determine whether the improvement in the patient's well-being is due to any specific action of the interstitial cells or to any other definite part of the testicle. They state that it is probable that the effects from absorption of this substance, whatever it may be, lasts more than one year. They report the history of a number of their patients. The first one upon whom they tried the experiment was a man, aged twenty-five years, who had had both testicles injured by a kick five years before. He was mentally apathetic and physically inactive. A double transplantation from a man, aged twenty-seven years, apparently had a beneficial effect upon him, in that he became more active, talked more, wrote better letters, comprehended jokes and had more sexual activity than before. After leaving the prison, he was employed in a lumber camp, and it was stated by the superintendent that he was better than the average laborer. Another interesting case was that of a man, aged fifty-four years, who had suffered from traumatic orchitis three years before the testicular grafting was performed. In this case double grafts were used. This patient, who had noticed

⁵⁴ Journal of the American Medical Association, May 29, 1920.

declining sexual activity, as well as mental languor, was apparently much benefited by the procedure. There was a return of sexual desire and strength, and he had a nocturnal emission four weeks after the operation. No spermatozoa were found in the secretion. An interesting matter in connection with this case, is that the patient's eyesight improved. The visiting oculist of the prison, who examined his eyes several months after the operation and compared the findings with those made some years before, stated that there was an improvement in vision of 50 per cent. In 2 of the 11 cases there was little improvement, if any. In 5 other cases the testicles removed from young rams were used, but when the author's report was published, too short a time had elapsed for them to draw any definite conclusions from these cases. In 2 cases, however, sloughing took place, one coming away entirely at the end of seven days and the other at the end of sixteen days, although in the second case a small portion of the gland remained at the end of six weeks. In three other cases half of the gland only was implanted, but in all of these sloughing began at the end of a week. The inference from these cases is, that grafts from animals of other species will not be retained.

Mühsam⁵⁵ also reports 3 cases in which he has performed the implantation operation. One was that of a man, aged twenty-five years, who had had both testicles removed because of tuberculosis. Sexual desire and potency gradually disappeared until, within the course of a year, he had developed many of the characteristics of eunuchs. In April, 1918, Mühsam implanted a healthy testicle into this man's tissues with good results, the graft healing without any complications. It was not until the following November, however, that he felt strong sexual desire. From that time he indulged in intercourse about once a week. In March, 1919, he married. Mühsam examined him the middle of April, 1920, and found him to be in the best of health. He had intercourse about once in three weeks and refrained from indulging oftener because he found it to be somewhat of a strain. In the other 2 cases the operation was performed upon subjects who presented bisexual characteristics. In this connection it may be stated that Lichtenstern also resorted to it for the relief of the same condition, having operated upon 7 patients so afflicted. Naturally, a complete change in the sexual impulses might be expected only after double castration and the implantation of a normal testicle. In view of the uncertainty of the result, neither Lichtenstern nor Mühsam felt justified in removing both testicles from their patients. Therefore, they both performed unilateral castration, followed by the implantation of a single testicle from a normal subject. Lichtenstern states that in every case there was a diminution of the homosexual impulse and a development of heterosexual inclinations. The patients were so well satisfied with the change that they did not care to have the same procedure performed upon the other side. Mühsam's patients were benefited, so he states, in the same way.

It may be of interest to explain how the healthy testicles were obtained

⁵⁵ Deutsch. med. Wchnschr., July 22, 1920.

in some of these cases. Mühsam states that in 1 of his cases he used a testicle that was retained in the inguinal canal and that in the other 2 they were obtained from a man who had suffered from a sexual psychoneurosis for years, and who was only too glad to be freed of these organs. At first a unilateral castration was practised, together with the ligation of the vas on the other side. After transitory improvement, his old symptoms returned and he wished to have the second organ removed.

With regard to technic, the author states that the testicle is freed from its epididymis and split in half and is then implanted underneath the external oblique muscle of the abdomen. In his last operation Lichtenstern did not suture the fascia over the testicle for the purpose of preventing any possible pressure upon the testicle, but he sutured some of the fat from the abdominal parieties around it. As regards after-treatment, Mühsam recommends the application of warm compresses for a few days so as to favor quicker vascularization of the implant. He found that heat from an electric light proved very serviceable in keeping the compresses warm.

Another question which arises in connection with this subject is the prevention of the development of senility by its use. Lydston and Voronoff, especially, have studied it in this respect and share the same opinion, namely, that by its use senility can be retarded and longevity probably increased. Lydston mentions 1 case in which the previously gray hair upon the arms and breast and the entirely gray eyebrows and beard became noticeably dark within a few weeks. He also considers sex gland implantation to be of great value in arteriosclerosis when not too far advanced. Other conclusions which Lydston has reached and which summarize the subject to date are as follows: Therapeutically successful, double or partial implantation of human reproductive glands in both male and female is practicable. So long as a vestige of the implanted gland remains, hormone is formed and observed producing effects that endure even after complete absorption has occurred.

Glands taken from a healthy dead body at a reasonable time prior to the beginning of decomposition are suitable material, and if implantation succeeds are of therapeutic value equal to those taken from the living body.

The hormone of the glands in question is stimulant, nutritive, tonic and reconstructive and should be beneficial in many forms of chronic diseases. It is apparently valuable in certain obstinate forms of chronic skin disease, notably in psoriasis, and it has also been found effective in anemia.

Gland implantation is quite uniformly effective in increasing physiological efficiency with the benefits accruing therefrom. It is not necessary that the implanted gland should remain permanently in order to secure beneficial results.

SURGERY OF THE EXTREMITIES, SHOCK, ANESTHESIA, INFECTIONS, FRACTURES, DISLOCATIONS AND TUMORS.

By WALTER ESTELL LEE, M.D.

THIS year's review of general surgery could not have a more fitting foreword than the message from Sir Berkeley Moynihan that appeared in the *British Journal of Surgery*, July, 1920. His "Ritual of a Surgical Operation" should become a part of the life of every surgeon. No living surgeon is better fitted to speak in this way, because of his rich experience, deep study and an unusual gift of expression.

He begins with the statement that every operation in surgery is an experiment in bacteriology. The success of the experiment in respect to the salvation of the patient, the quality of the healing of the wound, the amount of local or constitutional reaction, the postoperative discomforts and the postoperative complications depend not only upon the skill but also upon the care exercised by the surgeon in the ritual of the operation.

The "ritualist" must not be a man unduly concerned with fixed forms and ceremonies, but a man who, while observing with unfaltering loyalty those practices which experience and experiment have imposed upon him, refuses to be a mimic bound by custom and routine. He must set endeavor in continual motion and seek always and earnestly for simpler methods and a better way. *In the craft of surgery, the master word is simplicity.*

The ritual of an operation commences before the incision is made, and may needs continue for a long period of time after the wound is healed. In the transition of a patient from ill health to sound health, the operation itself is only one, though it may be the most important of all the factors concerned in this fortunate event.

The possibility of the patient's own tissues furnishing septic organisms in non-infected cases is so remote that it may be ignored entirely. It is an excuse to condone rather than explain an infection.

The bacteriological experiment on the patient may be conducted with one or two intentions: The exclusion of all organisms from the wound; the destruction of all organisms reaching the wound by a bactericide applied to the wound surface.

Strictly speaking, there is no aseptic surgery. In every operation some antiseptic is used on the patient's skin or the operator's hands. The term may be applied to that part of the operation which begins after the incision in the skin, and after this point the use of antiseptics is rarely necessary, is often undesirable and is almost always of greater harm than benefit. (This, of course, applies to clean cases—Reviewer.)

In speaking of the results of an operation, a surgeon may be a prejudiced witness as to his own efforts and a bad judge of his own merits. When surgeons speak, for example, of "healing by first intention," one means a wound which heals within a few days, leaving a thin straight narrow line of palest pink. Around this line the stitch marks appear "cold." There is no redness, no swelling, no stiffness or induration, and at the line itself there is the most accurate apposition of the skin edges. There is no discharge from the wound. There has been neither local nor constitutional reaction following the operation. By the same term another surgeon means a wound which is anything but straight; the edges are jagged, they do not meet accurately at every part, they overlap here and there; the line of healing is broad and irregular, raised and red, a sticky discharge oozes from the unapposed surfaces, and a scab may lie where this discharge has dried. The surrounding parts are tender, raised, red and doughy, or stiff. The stitches seem to sink into the skin.

The cleaner and gentler the act of operation, the less the patient suffers; the smoother and quicker the convalescence, the more exquisite his healed wound, the happier his memory of the whole incident, to him probably one of the most important events in his whole life. The results of our ritual, then, are not only expressed in the mortality—where the difference may be slight—but also in the quality of the healing of the wound and in the quality of the recovery from the operation in respect to security, rapidity, smoothness, completeness and finality.

In the ritual of a surgical operation the mysteries are imposed not only upon the high priest and the acolytes, but upon the congregation also. Every visitor takes part, no matter how remote, in the operation. In all clinics nowadays he is gowned, masked and his head is covered with a cap. But dirty boots and soiled trouser legs, conveying mud, dust and fecal matter from the street, are usually unnoticed. We have a vivid memory of the scorn visited upon us by inspectors from the Surgeon-General's office when we insisted that they cover their polished, but surgically unclean, boots and puttees with canvas one-piece leggings while in the operating room of our general hospital. This practice had been in use in our operating-room for some months, and was not discarded in spite of the inspectors' adverse criticism. It is interesting to read Moynihan's criticism of this break in technic and his description of our despised "folly."

In the method of the preparation of our hands, he regrets that it is still common to see hands washed in a basin of still water. The moment the hands are soaped and rinsed the water is polluted by the dirt washed off the skin. If the washing is continued, it is obvious that the hands are being constantly reinfected from the contaminated water. If the water is discarded, and fresh poured in the basin, the basin, still polluted by the water it formerly contained, defiles the fresh water. And it is not uncommon to see a piece of soap used to lather the hands laid down and picked up again regardless of the fact that each contact of the soap with an unclean surface is a source of soiling it. The best of all plans is to wash under running, sterile water.

Almost all commercial soaps are sterile. The outer surface, of course, may be polluted, but when this is washed or scraped away the exposed fresh surface of the soap is sterile. Two methods of using soap are satisfactory; to use a tablet of any ordinary soap which has been immersed in a cresol for a half hour; or to sterilize some green soft soap in a flat dish in an autoclave, and apply it with a sterile gauze sponge in sufficient amounts to form a good lather. After washing for not less than fifteen minutes, the hands and forearms should be gently rubbed with gauze wet in alcohol and biniodide solution. (We do not agree with the necessity for the biniodide.—Reviewer.)

The wearing of gloves is often a mere fetish. How often are they put on without their outer surfaces being touched or stroked by the bare hand? How often are they considered a protection for the surgeon rather than the patient? The advantage of the dry glove is that it is more comfortable to wear during a long list of operations, and that the hand, being covered with a sterile dry powder, is kept free from moisture. (Not entirely.—Reviewer.) A chance puncture of the glove does not involve as great a possibility of the escape of infective skin secretions into the wound. Gloves should be kept on the hands until the dressing of the wound is complete, and until the gown is removed. If gloves are properly sterilized and properly put on, the covered finger may be used to explore any part of the body with impunity.

No bare arms of any of those engaged in the operation should be seen. Either a long-sleeved gown should be worn, or sleeves which fit firmly around the wrist, there to be covered by the cuff of the glove.

An ideal skin disinfectant should be cheap, easily accessible, simple in its application, non-irritant, capable of penetrating the skin to some depth; it should be effective in destroying in a short time all of the organisms found on, or in the skin, and it should do nothing to prevent or delay the clean or speedy healing of the wound. Though *iodine* is the agent most commonly employed, Moynihan believes that both clinical and experimental evidence seems to show that it is an agent of second rate. He claims there is nothing to recommend it but the ease of application and the coloring of the skin; its efficacy is far less than is required and it is a powerful irritant. (We cannot agree with this sweeping condemnation.—Reviewer.) *Picric acid*, in an alcoholic strength of a 3 or 5 per cent solution, gives better results than iodine, but it does not penetrate deeply, and it is not of sufficient bactericidal value. He advocates a three-stage preparation. Abundant washing with soap and water, gentle friction with an alcoholic solution of biniodide of mercury in a strength of 1 to 500; this is followed by drying, and then Harrington's solution is applied for two to three minutes. Throughout all operations the skin is covered with towels, so that no friction of the hands against it is possible.

The hands should not touch the skin at all; viscera should never be allowed to lie upon it. As soon as the incision is made, cloths of several thicknesses of gauze or toweling are fixed to the skin edges and dip well into the wound. If these "tetra" cloths lie loosely on the parts around the wound, they ruffle up during the movements of the surgeons hands.

If powder is dusted on the under surface of them, it is soon found to lie in the wound. The towels, therefore, must be held at points distant from the wound, so that they are kept stretched and tight throughout the operation. When they are removed at the end of the operation, the skin covered by them is washed over with alcohol and then with Harrington's solution before any stitches are inserted.

The wound should be made by a clean, firm sweep of the knife. All the vessels should if possible, be clipped before being cut, the same as in a hernia operation, but certainly the moment they are cut. The tips of the artery clips should be narrow, almost pointed, and only the end of the vessel should be grasped.

Though traction is necessary in cervical gland and goiter operations, it must be avoided in abdominal work. The forcible and merciless retraction of the abdominal wall throughout a long operation cannot fail to produce shock and suffering afterward. The best retractor is the gentle, light hand of a trained assistant, used mercifully when it must be used at all. But with adequate incisions, retraction is very little needed during the greater part of most operations.

Dissection may be carried out in two ways: By the knife or by gauze "stripping." If, by the knife, the movements should be short, sharp and close together, so that if recorded on a moving drum, the picture would resemble a "feather edge." And the knife must be sharp. Big, heavy, clumsy movements, with a dull knife, hurt the patient and leave the parts less fitted to heal. Throughout the operation there must be no undue exposure of the parts. In a large dissection, such as that required in the removal of a cancer of the breast, where the dissection extends from the axilla to the umbilicus, and from the opposite pectoral muscle over the latissimus dorsi, with the skin turned back, the bared area in such a wound is very extensive; it should never be seen as a whole. As one part of the dissection is completed, hot moist cloths are placed over the raw surface to prevent drying and chilling, and the chance of contamination. Similarly, in abdominal work, only that part of the operative field should be seen with which the operator is at the moment engaged.

Contamination may occur during the operation, and therefore the various clips, scissors, retractors or other instruments should be sterilized as often as they are soiled. If, for instance, a pair of scissors is used to open the intestine in a case of gastro-enterostomy or colectomy, or needles are used to suture viscera together, they are at once discarded, and never used again until they have been boiled.

In operations for malignant disease, frequent sterilization of the instruments is most necessary. Every instrument used in this dissection—knife, clips, scissors—may possibly be brought into contact with a cancer cell. When once used, it is therefore laid aside, and not taken up again until it has been reboiled. Cancer cells, as Ryal and others have shown, can be grafted on to the patient's own tissues and develop a new deposit of cancer. It is obvious that the graft may be carried on any instrument, or on the gloved hand.

The ligature and suture material, which must remain within the

wound, should achieve its purpose—namely, hold the parts together and close the vessels; disappear as soon as its work is accomplished; be free from infection; and be non-irritant. The only material which can be made to fulfil these conditions is catgut, and the smaller sizes especially. Catgut can be perfectly sterilized. Moynihan prefers the method of Claudius, in which the catgut is soaked in a solution consisting of iodine (1 per cent) and potassium iodide (1 per cent) in water. He has modified the method, because all of the iodine is not dissolved in these proportions, by using solutions made in accordance with their atomic weights, iodine in a strength of 1 per cent and iodide of potassium in a strength of 1.75 per cent. The catgut is soaked in this for ten days or more until it is almost black in color. He further believes that silk is unnecessary for intestinal sutures; also, that unabsorbable suture material is frequently the cause of jejunal ulcer following gastro-enterostomy.

The most important person present at an operation is the patient. Unfortunately, this truth is not always and everywhere recognized and remembered. Moynihan uses routinely atropine and morphine in his preliminary preparation. He also emphasizes the value of a darkened and absolutely quiet room for the starting of the anesthesia. No talking is allowed, and the patient is encouraged to sleep. Under these conditions, there should be few occasions when shock will follow a properly conducted abdominal operation, which consists in the patient being kept warm while on the table, the gentlest handling of all tissues and organs and the most accurate hemostasis.

Every detail in every operation is important, and should be conceived practised and tested with unwearying patience by the operator himself, and by him in conjunction with all his assistants.

In all the movements of the surgeons, there should be neither haste nor waste. It matters less how quickly an operation is done than how accurately it is done. Speed should result from the method and the practised facility of the operator, and should not be his first and formal intention. It should be an accomplishment, not an aim. Every movement should tell, every action should achieve something. A manipulation, if it requires to be carried out, should not be half done nor hesitatingly done. It should be deliberate, firm, intentional and final. Infinite gentleness, scrupulous care, light handling and purposeful, effective, quiet movements, which are no more than a caress, are all necessary if an operation is to be the work of an artist, and not merely of a hewer of flesh.

With such a ritual, no surgeon could be a mere "hewer of flesh." To have such an ideal is the privilege of every surgeon, but the opportunities to acquire "the practised facility" of such a ritual are rarely offered the young American surgeons of this generation. In most large medical centers, the conditions are very accurately described by Müller,¹ in his chairman's address before the Section of General Surgery at the Boston meeting of the American Medical Association in 1921. The recent

¹ Journal of the American Medical Association, August 31, 1921, **77**, 505, No. 7.

graduate, finished with his hospital internship and determined to become a surgeon, works in the outpatient clinics of one or more hospitals, the laboratories and dissecting rooms of the medical school, and sooner or later (usually later), attains a position of assistant surgeon to a surgical service. He may do a certain amount of clinical research, he acquires the art of surgery, and, in some cases, eventually succeeds to a major position on a hospital staff. Unless, during this period of ten to twenty years, he is so fortunate as to be associated with the type of men who realize their responsibility for the training of the next generation of surgeons, he goes it alone. The opportunities for post-graduate work in any special subject have been, until recently, "side shows," as Clifford Albutt describes them. Two years ago Bevan made the statement that the postgraduate work in America was about on a par with the undergraduate teaching of fifteen years ago. That there is a need at the present time for graduate teaching and training in surgery cannot be questioned. And it is generally being realized that such treatment should be under the aegis of a university. In 1917, the clinic at Rochester, recognizing this fact, merged its foundation with the University of Minnesota and became an integral part of that institution. Graduate teaching in surgery needs abundant resources, the highest type of teachers, opportunities for research and original investigation and clinical work, and, above all, the proper standards and traditions inseparable from a great university. Minnesota, Harvard, Pennsylvania, California, Tulane, Chicago and Washington are seriously considering organizing their schools, so as to include separate or partly combined schools of medicine. It is true, as Müller says, from his personal experience, the proper organization of graduate instruction in surgery is a difficult matter. It cannot be approached in the same way as the undergraduate school. Quoting Makins, the most successful teachers of undergraduates, probably by reason of the dogmatic instruction given, and the necessary limitations of its scope, are by no means necessarily the type who can interest and enthuse the graduate. This was peculiarly demonstrated in the school developed by Colonel Edward Martin at the Medical Officers' Training Camp at Oglethorpe in 1918. The atmosphere of the undergraduate medical school, where the main object is to impart elementary and practical instruction, is unsuitable to the acquirement of intimate acquaintance with detail, and in a considerable degree, to the freedom of thought, the skeptical attitude toward accepted and adopted views, and the single-minded desire to advance medical science by research which should animate the graduate who seeks to follow the higher paths of medicine. The organization of the work in the medical sciences, the provisions for research, the library, etc., are comparatively easy matters if the financial resources are sufficient. But, except in the unusual Mayo Clinic, there is no place in America where the volume and variety of clinical material is large enough to furnish a turnover of sufficient material for the clinical work of a large graduate school. The only answer is for the university to seek affiliations with several hospitals in the community. Lyons²

² Journal of the American Medical Association, October 20, 1917, 69, 1307.

goes a step further and says that every ethical private clinic in the country—every clinic large enough to afford training for even one young medical graduate—should be affiliated with some university which should have the power to supervise that man's graduate training and in the end should attest, after proper examinations, his technical proficiency. The leading surgeons should realize and be made to appreciate their responsibilities of teaching in their clinics and not to use them solely as places of business.

At the present time there are two large groups for which graduate instruction in surgery is needed: (1) Those who, after graduating in medicine, wish to pursue a course which will prepare them for the practice of surgery and lead to a degree. (2) Those who have been engaged in the practice of medicine for a number of years and wish to prepare for the practice of surgery; or having practised surgery are desirous of perfecting themselves in the more recent developments in diagnosis and practice. The first is the ideal type for the graduate school and a graduate school organized along the lines of the University of Pennsylvania offers an opportunity never before presented to American surgeons. Those who have blundered through the haphazard training of the past can fully appreciate what this would have meant to them.

A different problem is presented by the second group, namely, those who, having been in general practice, wish to prepare themselves for the practice of surgery, or having practised surgery for a number of years, desire to perfect themselves in more recent developments in diagnosis and practice. The difficulty in dealing with this group is that no two men will have the same preliminary training, same capabilities, same ambitions and the same opportunities. Therefore, their problems must be met individually. The plan at the University of Pennsylvania first began with a definite time schedule, but it failed because graduate work can be done only to a limited extent in classes. Müller concludes, from their experience at Pennsylvania that this entire group of men should start in a well-planned course of eight months' duration called an instructional year, with the time equally divided between the clinical scientific branches. By personal contact and reports from instructors, the director should be able to learn the capabilities of the individual, and by a sorting process meet each requirement, even to the point of discouraging further attendance in the school. The instruction in anatomy, pathology, physiology and biochemistry is rigid at first but becomes flexible in time and finally so loose as to allow the student full play in the cultivation of initiative in surgical research. By the end of the year the better type of man will be on a par with those of group I and become eligible for a degree. The others will at least have spent a profitable year. Those men continuing for the full course of three or more years, become a part of the personnel of the school; instead of a student he becomes a fellow. He may be an assistant, a resident surgeon, chief of an outpatient department, teach his juniors, share responsibility with his seniors. He must catch the scientific idea as well as develop technical proficiency. By such a train-

ing a young surgeon has his work organized, and his initiative encouraged. He is saved from a plethora of clinical work (which has caused the failure of many a good man), from engorgement with routine observation, diagnosis and the care of the sick. He is given time for laboratory and literary work, for meditation and expansion and the development of originality. Under such conditions many, instead of a very few, young men would be given the opportunity of developing into surgeons who are "artists" instead of "hewers of flesh."

Shock.—Wilensky, in the June number of PROGRESSIVE MEDICINE of this year, has so completely covered the subject of shock that it has been decided to omit this subject from our review this year. The reader is referred to pages 70 to 76 of PROGRESSIVE MEDICINE, June, 1921.

Blood Transfusion.—The subject of blood transfusion was reviewed at length last year. Though this year's literature contains more subject-matter than in any of the past years, practically nothing new has been contributed. Pemberton³ publishes a very timely warning to give practical consideration to the dangers associated with blood transfusion. Nothing tends to bring a therapeutic measure more quickly into disrepute than its abuse. As a therapeutic agency, blood transfusion is now a recognized procedure, but it has definite indications, certain limitations and very real dangers, all of which should be more generally understood than is evident at the present time. The dangers, we must admit, have not been emphasized in literature as have the advantages. The principal dangers associated with the transfusion of blood from one person to another are: (1) The introduction of air and blood clots as emboli; (2) acute dilatation of the heart; (3) the transmission of infection; (4) agglutination or hemolysis of the donor's or recipient's corpuscles.

Air in the circulatory system to be dangerous must be present in comparatively large quantities, for all surgeons have clinically experienced the introductions of small quantities into the circulation without producing any appreciable effect. We can recall one instance in a human and another in a dog when a small quantity of air was inadvertently admitted while transfusing blood. Cyanosis, dyspnea, rapid, weak pulse followed, and, though the conditions were alarming, there were no fatalities. With the simple technic of the present day, both for the whole blood and the citrated blood, there is no excuse for this accident occurring. By the employment of a small caliber needle for entering the recipient's vein and allowing the blood to flow only under low pressure, blood clots of sufficient size to produce harm will not be introduced.

The dangers arising from an acutely dilated heart demand instant recognition. The premonitory dry cough, to which Unger refers, has been almost constant in this complication in our experience. In the aged, with marked arteriosclerosis, in extreme anemia where there is frequently a myocardial involvement, and in all persons with sus-

³ Collected Papers of Mayo Clinic, 1919, 11, 633.

pected myocardial disease, the quantity of blood injected must be limited, and caution must be exercised to avoid the too rapid loading of the right heart.

The possibility of transmitting disease from donor to recipient has not been sufficiently emphasized. Most writers are content merely with cautioning against syphilis. While the recorded number of patients acquiring syphilis in this way is indeed very small considering the prevalence of the infection, our admittedly inadequate means of always detecting its presence should place us constantly on guard. Syphilologists agree that the Wassermann reaction is not an infallible test. According to Stokes, 35 per cent of syphilitics in the latter stages of the disease and in all syphilitics during the first few days of the primary lesion, have a negative Wassermann. A competent syphilologist should pass upon the blood of every prospective donor. In accepting a professional donor with no knowledge about the individual except a negative Wassermann label, the responsibility becomes very great. The question then should be whether the indications for transfusion are so urgent in character as to warrant this risk. For example, Pemberton cites a young woman, who has become anemic from excessive or prolonged menstruation. Transfusion will check this bleeding, if there is no underlying malignancy, quicker than anything else. But, in his opinion, unless one of her blood relations can be obtained, he advises against the procedure and urges that any other conservative measure be tried rather than the employment of a professional donor. Of course, there are acute critical conditions, such as hemorrhage, where the risk of transmitting syphilis is of secondary importance.

The chief immediate dangers are, of course, the introduction of incompatible blood into the vein of the recipient, agglutination or hemolysis of the red blood cells of either donor or recipient. The clinical symptoms appear promptly, usually after 50 to 100 cc. of blood have been given. First, tingling pains creeping over the body, a fulness of the head and oppressive feeling over the praecordia, and, later, excruciating pain localized in the lumbar region. Slowly, but perceptibly, the face becomes suffused, a dark red to a cyanotic hue, respiration becomes shallower and the pulse-rate, at first slow, suddenly drops to 20 to 30 beats a minute. The patient may lose consciousness for a few minutes. In one-half of their cases an urticarial eruption, generalized all over the body, or limited to the face, appeared with these symptoms. Later, the pulse may become very rapid and thready, the skin cold and clammy and the patient's condition very grave. In from fifteen minutes to an hour, a chill occurs, followed by a high fever, of from 103° to 105°, and delirium may develop. Jaundice occurs later in a few cases. The macroscopic appearance of hemoglobinuria is almost constant. Fortunately, the symptoms usually appear, as we have said, after the first 50 to 100 cc. of blood have been given, and, if the condition is promptly recognized and the operation stopped, a fatal result will be avoided. Preliminary blood tests, such as are now generally used, will prevent this catastrophe. Pemberton makes the positive statement, which is almost universal in the literature up to the present time, that the

blood of Type IV is suitable for any recipient. During the last winter, with two different donors belonging to Type IV, we found their blood agglutinated the red cells of the waiting recipient. Fortunately, this agglutination occurred only in the preliminary laboratory tests which we routinely make just before the transfusion was started, but we would not have dared to use these donors for these recipients. The donors were medical students and were not only typed by a serologist above criticism, but they were again typed by this man after this experience and no error was found, and finally the work was checked by a second serologist and the typing confirmed. We feel sure that the statement that Type IV blood can be used with impunity for any recipient is not absolutely true and therefore not entirely safe, and that the only safe method of choosing a donor with our present knowledge is the matching of the two bloods against each other just before the transfusion is performed.

SERIOUS REACTIONS TO REPEATED TRANSFUSIONS IN PERNICIOUS ANEMIA.—From a review of the literature and a study of 3 cases at Johns Hopkins Hospital in which, after a large number of repeated transfusions, there occurred severe reactions after the transfusion of apparently compatible blood, Bowcock⁴ concludes:

1. In certain persons suffering with pernicious anemia who have been transfused repeatedly, transfusion becomes self-limited because of the inadequacy of our present methods of selecting suitable donors.

2. The difficulty having been once discovered, no further attempt should be made to transfuse these patients.

3. The severe reaction is probably due to a severe anaphylactic reaction, and not to hemolysis *per se*. Blood matching should be carried out with the greatest care, whenever possible the incubation period should be at least two hours, or longer.

4. Blood serum free from cellular elements may produce bone-marrow stimulation.

5. Members of Group IV cannot be regarded absolutely as universal donors.

RETRANSFUSION OF BLOOD.—Schweister⁵ reports 21 cases of ectopic pregnancy in which he reinfused the blood. He finds it a useful and, in many cases, a life-saving procedure. Its freedom from danger depends upon three factors: freedom from infection, absence of blood clots, and intact condition of the blood cells. The first two conditions are easily complied with, but the last is not so simple. He lost one patient, a married woman, aged twenty-seven years, from hemoglobinuria, although he had performed the reinfusion exactly as in all of the other cases. If it should be discovered that hemoglobinuria, in spite of all known precautions as regards injury to the red blood cells, cannot be prevented, he fears that the harmlessness of the useful measure may be questioned. This is the first report in literature of a death following this procedure.

Retransfusion of blood in cases of intra-abdominal hemorrhage has

⁴ Johns Hopkins Hospital Bulletin, 1921, **32**, 83.

⁵ München. med. Wchnschr., Munich, June 10, 1921, p. 691.

been employed at the Pennsylvania Hospital, Philadelphia, by Stewart, Gibbon, Klopp and the writer during the last three years without any untoward complications, and with the most satisfactory results. We feel that it should be a routine procedure.

AUTOTRANSFUSION OF BLOOD FOR HEMORRHAGE.—The therapeutic value of blood transfusion as a means of stopping hemorrhage was observed very early in the practice of blood transfusion. The clinical data has been ample but there is no experimental proof in literature. Lewisohn observed that the coagulation-time of blood was reduced even by autotransfusion. Thus, in a dog, after 300 ccm. of autotransfusion, the coagulation-time was reduced from five minutes to ten seconds. Love⁶ tried to demonstrate this upon a number of dogs, but was unable to develop a satisfactory technic. He was convinced, however, that wounds which would have ordinarily bled severely were easily controlled after autotransfusion.

Grant and Frazier⁷ have recently employed autotransfusion rather differently than usual, and this report is perhaps the first of its kind. It has been their routine practice for some time to transfuse, post-operatively, all cases upon whom a suboccipital exploration has been performed. The procedure is, of necessity, a prolonged one, accompanied by considerable shock to vital centers, and they had found that immediate transfusion inspired a prompt reaction and improved the postoperative course. The patient in question, having no money to pay for a donor, unfortunately belonged to Type III, the least frequent type. They had no donors of this type on their list. As the patient was large, stout and plethoric, and as experience had shown them that following redrawal of 500 cc of blood the cell count and hemoglobin returned to normal in five days, it was decided to draw blood from the patient—citrate it—and then reinfuse it after the operation.

The blood was obtained, kept in a 0.2 per cent sodium citrate solution in a refrigerator and retransfused after the operation. No reaction was noted, and four days after the operation the blood picture was almost normal.

They suggest that autotransfusion might be considered where a donor cannot be obtained for any reason, and in which a patient with a high normal blood picture faces an operation known to be attended with shock and hemorrhage, if he be bled sufficiently far enough in advance of his operation to allow his blood picture to return to normal. This blood may be kept with safety and retransfused at a time when such a procedure may be life-saving.

Matthews,⁸ in discussing the subject of rupture of the spleen before the New York Academy of Surgery, said there was a general impression among surgeons that bleeding into the peritoneal cavity was a total loss of blood to the patient. Sweet, of Philadelphia, has performed the experiment of putting blood into the peritoneal cavity of animals, and in a short time found the red blood cells in the thoracic duct. It is not

⁶ Medical Record, 1921, **99**, 58.

⁷ Annals of Surgery, August, 1921, **74**, No. 2.

⁸ Ibid., **74**, 249. No. 2.

only a waste of time to remove all the blood from the peritoneal cavity, but it is actually robbing the patient of blood. One may remove the clots but the fluid blood should be allowed to remain, for in a short time the red blood cells will return into the circulation.

TRANSFUSION WITH IMMUNIZED BLOOD IN A CASE OF INFECTIVE ENDOCARDITIS.—The treatment of various infections by the transfusion of blood from donors immunized against the infecting agent has suggested a new therapeutic procedure. We referred to this in our review of last year in a case reported by Polak.⁹ Levinson¹⁰ reports a case in which the streptococcus was isolated from the blood of a case of infectious endocarditis. A healthy donor was immunized by injections of vaccine given to the donor prior to the first transfusion and continued throughout at an interval of four days. Four transfusions were given by the citrate method, from 500 to 600 ccm. of blood at each injection. In all, 2200 ccm. were transfused within a period of five weeks. The patient died in spite of the procedure and Levinson states, without reservation, that beyond the maintenance of the patient's strength and the relief of the anemia, the transfusions were of no avail.

The Leukocytes after Hemorrhages.—It seems quite generally accepted that a leukocytosis occurs after hemorrhage, though it is usually referred to in a very casual way in the text-books. From a review of the literature of recent years, it is evident that confusion exists not only as to the actual occurrence of post-hemorrhagic leukocytosis, but also as to the duration of this leukocytosis. Musser¹¹ reports his results of the white cell counts made upon animals, in whom the quantity of blood lost could be accurately controlled. Eight dogs in all were used. From the results of these experiments and the review of literature, it is evident that, as a general rule, hemorrhage causes a leukocytosis. This is of importance not only in the diagnosis of internal hemorrhage, such, for example, as occurs after contusion of the abdomen, but also in the differentiation of various abdominal conditions. Musser further found that this leukocytosis is made up largely of an increase in the polymorphonuclear neutrophiles. The eosinophiles do not disappear from the circulating blood as they do in the leukocytosis of sepsis and other conditions. The factors which seem to be concerned in the pathogenesis are retention of the leukocytes in the blood stream during hemorrhage by adhesion to the vessel walls with diminution of blood volume, and, presumably, an outpouring of the white cells from the bone marrow after hemorrhage in response to an unknown stimulus.

Blood Analyses following Acacia-glucose Injection. White and Erlanger,¹² experimenting on dogs, report the following changes in the blood after the intravenous injection of strongly hypertonic glucose and gum acacia solution.

The immediate effect was a marked increase in blood volume; in

⁹ American Journal of Obstetrics, 1919, **80**, 291.

¹⁰ Journal Laboratory and Clinical Medicine, 1921, **6**, 191.

¹¹ American Journal of Medical Surgery, July, 1921, Nos. 1 and 592, **172**, 40.

¹² American Journal of Physiology, November, 1920.

normal and asphyxiated animals the blood volume then gradually fell toward, but did not reach, normal for several hours. The blood volume, markedly diminished in shock, is increased to above normal level by the injection, and then gradually falls to, or below, its normal level.

The absolute plasma protein is increased slightly, or not at all, in normal animals and in asphyxiated animals; in an animal which had been bled, there was a slight increase when the amount withdrawn was allowed for. The absolute amount of plasma protein which is markedly diminished in shock, is increased by the injection and the increase continues for some time after the injection. It is believed that at least a part of the increase in plasma protein following the injection in shock is due to a passage of protein through the vessel walls.

Gum acacia seems to take the place of plasma protein in holding water in the circulation.

There is a marked hyperglycemia immediately after the injection in normal animals; this is accentuated by morphine and asphyxia. The blood-sugar value falls to, or nearly to, normal within two hours. In shocked animals the blood sugar behaves much as in normal animals. There is only a trace of sugar excreted by normal animals excepting when morphine or asphyxia causes marked glycosuria. Shocked animals without morphine excrete some sugar unless, as a result of the shock, there is a suppression of the urine.

The fluid drawn into the blood stream brings with it chlorides of a concentration equal to the chloride concentration of the plasma, but the diffusion into the blood stream of sufficient additional chlorides, to bring the chloride concentration of injected fluid up to that of the plasma, is not complete for several hours.

There is no suppression of urine in normal animals as a result of the injections; if anything, the rate of secretion is slightly increased. No hemolysis, hematuria, hemoglobinuria, albuminuria, cylindruria, fluctuations of body temperature or any other untoward effects were observed as a result of the injections.

Preoperative Conditions.—ACIDOSIS IN OPERATIVE SURGERY. The importance of acidosis in estimating surgical risk or as an indicator for postoperative complications is being realized more and more. It is a term used to signify an impoverishment of the body in bases. The alkali reserve is the criterion of the acid base balance of the body, and can be accurately determined by the Van Slyke method. The fall in alkali reserve during operation depends not only upon the anesthetic and the duration of the operation, but upon the nature of the operation and the occurrence of hemorrhage and shock. The fall in alkali reserve bears a close relation to the fall in blood-pressure and pulse-pressure, therefore, if the fall in blood-pressure is prevented, there is a saving in alkali reserve. Farrar¹³ found that the giving of a glucose solution intravenously during an operation at the rate of 0.8 gm. of glucose for every kilogram of body-weight each hour of the operation lessened the acidosis incident to an operation by promoting metabolism. If a 6 per-cent

¹³ Surgery, Gynecology and Obstetrics, April, 1921, 32, 338.

gum acacia is given with a 20 per-cent glucose solution at this same rate, not only will the metabolism be promoted but there will be a distinct aid to the maintenance of blood-pressure. If carbohydrates are fed before and after operation, together with the use of bicarbonate of soda, the incidence of acidosis will be lessened. Farrar's conclusion that all well-equipped hospitals should employ a paid physiologist for the study of problems on the living tissues, as the pathologist studies them in the dead tissues, is to be urged.

Postoperative Conditions.—ACUTE POSTOPERATIVE DILATATION OF THE STOMACH. There is no subject which should be of more interest to the active operating surgeon than that of acute postoperative dilatation of the stomach. Novak¹⁴ states that it is a complication of much greater frequency than has usually been recognized. It is too often undiagnosed or mistaken for some other condition, and the surgeon's failure to recognize its nature is always serious and frequently fatal to the patient, while, on the other hand, there are few surgical complications which respond so satisfactorily when properly recognized and treated. Müller expresses it in the following way: "Here the diagnosis is everything." Curiously, it was first recognized and described by Fagge,¹⁵ in 1873, and his description suffices for present-day purposes: "A dilatation of the stomach independent of obstruction at the pylorus or in the small intestines."

Symptomatology.—Vomiting, of course, is the most prominent symptom. In a large proportion of cases it undoubtedly occurs soon after operation and is usually considered as postanesthetic vomiting. In about one-third of the cases it occurs within the first two days after operation and Borchgrevinkas¹⁶ reports 1 case occurring sixty-one days after operation. The vomiting is characteristically regurgitant, the gastric contents being spit up with little retching or straining, and little relief occurs, the fluid appearing to be only an overflow from the stomach analogous to the urinary overflow of retention. The amount vomited may be small or enormously large. Most frequently the vomited material is greenish or brown, but in the latter stages it may become almost black. The large amount of vomitus, far exceeding the fluid intake, is very characteristic, and is an evidence of a marked hypersecretion of the stomach. Pain is almost always a symptom, but of varying severity. Usually it is but one of epigastric distress. Collapse is noted in practically all severe cases, the pulse becoming rapid and thready, the skin cold and moist, the eyes sunken and hollow, the respiration rapid and shallow. Many authors emphasize the great thirst and the scantiness of the urine, both obviously the results of the great loss of body fluid by vomiting.

Of the *objective symptoms*, distention of the stomach is the most characteristic. The enlargement occupies chiefly the left side of the abdomen, in mild cases being above the navel, while in severe cases it may descend into the pelvis. At operation, it has frequently been mistaken

¹⁴ Journal of the American Medical Association, July 9, 1921, No. 2, **77**, 81.

¹⁵ Guy's Hospital Reports, 1873, series 3, 18, 1.

¹⁶ Surgery, Gynecology and Obstetrics, 1913, **16**, 662.

for a pancreatic cyst. The instrument of precision, which, to quote Deaver, makes certain the diagnosis of acute dilatation of the stomach, is the stomach tube, the introduction of which is followed by the escape of large amounts of gas and fluid, with immediate collapse of the stomach and disappearance of the abdominal distention. We have actually observed this in one case which was operated upon for a supposed intestinal obstruction and, fortunately, this diagnostic test was applied to the cystic tumor before it was opened with the knife. The fluid contents usually are of a dark brown color resembling rootbeer. The two post-operative conditions which are most apt to be mistaken for acute dilatation of the stomach are peritonitis and postoperative ileus. The differential diagnosis, however, should not be difficult, and the stomach tube will decide the matter.

The prognosis of this grave surgical complication depends entirely upon its early recognition. In former years, when it was usually unrecognized, the mortality was very high, but with the earlier recognition the mortality is showing a very gratifying decrease from year to year. Neck¹⁷ gives the highest figures, 73.43 per cent. Sixteen cases have been reported in literature of gastric dilatation observed during operation, and it has been our privilege to observe one during the last month while performing a hysterectomy for uterine fibroid. In all of the cases except that of B. J. Lee, and including the one above referred to, quick relief was obtained from the distention by the prompt passage of the stomach tube, and redilatation did not occur except in the one case, that of B. J. Lee,¹⁸ in which death occurred very soon after the patient left the table, and the postmortem revealed enormous dilatation of the stomach.

The etiology and mechanism of this condition has received a great many explanations. The two most prominent being: (1) The theory of duodenal occlusion by the upper border of the mesentery, with the contained mesenteric vessels; and (2) the theory of paralysis of the muscular walls of the stomach. Rokitansky,¹⁹ in 1863, first suggested the mechanical possibility of occlusion of the lumen of the duodenum by the mesenteric vessels. Many others since then have reported cases in which this mechanical explanation seemed to be the cause. The objections to this theory of duodenal occlusion, which up to a few years ago was the most widely accepted, are summarized by Novak as follows:

1. Duodenal dilatation is by no means a constant in gastric dilatation, occurring to a noticeable degree in only 25 per cent of cases (Dolin²⁰).

2. There is only one case in the literature, that of Baumler,²¹ in which the obstruction was sufficiently definite to cause any marked constriction of the duodenum. In this case the postmortem examination disclosed a reddened groove, 2 cm. in width, on the upper surface of the bowel, after a release of the constriction. We recall a postmortem exam-

¹⁷ München. med. Wehnschr., August 7, 1906, **53**, 1561.

¹⁸ Annals of Surgery, April, 1916, **63**, 418.

¹⁹ Lehrbuch der Pathologischen Anatomie, 1863, ed. 3, vol. 3.

²⁰ British Journal of Surgery, July, 1918, **6**, 125.

²¹ München. med. Wchnschr., 1901, **1**, 657.

ination in 1903 at the Pennsylvania Hospital, Philadelphia, of a post-operative gastric dilatation in which Longcope demonstrated two white bands, 0.5 cm. in width, upon opposite surfaces of the duodenum. This case, however, was not reported in the literature.

3. It would seem impossible for duodenal occlusion to cause such a sudden dilatation of the stomach as has been noted in a number of cases, especially those which have been observed during operation.

4. Genuine duodenal obstruction, as by tumors, bands, etc., is characterized by more sudden onset than acute dilatation; by more intense pain; by earlier prostration; and the vomiting, while it occurs, is apt to be less constant and less copious than occurs with acute dilatation of the stomach. This is illustrated in the case reported by Harrigan,²² in which volvulus of the stomach occurred as a result of incarceration of the upper jejunum in the fossa of Treitz. The postmortem findings showed the stomach to be "extremely swollen, red, congested, as in the case of a loop of obstructed intestines in a strangulated hernia." In postoperative dilatation, the stomach is thin-walled, without congestion or other evidence of interference of the circulation.

5. Connor suggests that as a *sine qua non* of the duodenal occlusion theory, the small intestine must sink into the pelvis and thus make traction on the mesentery. At least in Novak's two operative cases and in our own, the patients were in the Trendelenburg position.

6. If the duodenal occlusion was such an important factor, one would expect that a gastro-enterostomy would give certain relief; as a matter of fact, this operative procedure has always been unsuccessful.

7. If there was always a definite mechanical occlusion of the duodenum, it would seem improbable that a large proportion of patients, certainly more than one-half, would have recovered by the simple use of the stomach tube, without operation and without postural treatment.

8. Acute gastric dilatation has occurred in a number of cases following the operation of gastro-enterostomy.

The trend of modern opinion was first expressed by Brinton,²³ in 1859, as follows: "It is evidently a lesion of the nervous tissue connected with the stomach; a lesion which, whether structural in the sense of being recognizable by the aided or unaided eye, or merely what our ignorance conveniently terms 'functional,' prostrates (often apparently paralyzes) the stomach in all its tissues, and in all its offices. Its mucous and muscular coats, its secretion and motion, respectively, are alike interfered with; nay, more, those muscles of the locomotive system, which are linked with the contractile tissues of the stomach in the ordinary act of vomiting, are also affected. In short, it is not merely the sympathetic but the cerebrospinal center, which is injured or deranged—a fact that seems to compare with the violent pain and general prostration, in pointing to the prevertebral center (or solar plexus) of the former, or to pneumogastric trunks of the latter, as the parts chiefly affected.

The physiology of the motor activity of the stomach, as now understood, confirms this theory of Brinton. The extrinsic nerves of the

²² Annals of Surgery, May, 1919, **69**, 510.

²³ Lectures on Diseases of the Stomach, 1859, pp. 343, 348, 353.

stomach are, of course, the vagus and the splanchnics. The former are considered as being chiefly motor, and the latter inhibitory. Carrion and Hallion²⁴ demonstrated that section of the vagi in animals results in acute dilatation of the stomach. Hartwell²⁵ observed the same thing in a human being upon whom he was operating, in which the vagus nerve was accidentally severed during a difficult thyroidectomy.

That abdominal injury may reflexly produce gastric paralysis is certainly no more remarkable than that a pithed frog's heart may be made to stop in diastole by a mere light tapping on the frog's abdominal wall with the handle of a scalpel. Of the same general type of reaction is the atony of the bladder, with retention of urine, seen so frequently after operations about the perineum or anus. Similar, also, is the sudden extreme local paralysis of the uterine wall observed occasionally during curettage, to the dismay of the gynecologist, for the relaxation is so extreme that no resistance to the curette can be felt, and the operator fears that the uterus may have been perforated. The afferent impulse in gastric dilatation may also have its origin elsewhere than in the abdominal cavity, as, for example, those cases which follow injuries to the extremities. It is scarcely worth while, in the present state of our knowledge, to speculate as to whether the reflex results from an inhibition of the vagus or a stimulation of the splanchnics; nor as to the relative importance of the extrinsic nerves and the local nerve mechanism of the stomach in the plexuses of Meissner and Auerbach. The weight of the evidence is overwhelmingly in favor of the paralytic theory of postoperative dilatation of the stomach.

There has been much discussion as to the role played by the anesthetic in the production of acute postoperative dilatation of the stomach. The many cases reported of dilatation occurring in non-surgical condition, *i. e.*, when an anesthetic has not been given, is conclusive evidence that anesthesia is not essential. There is much to support the belief that it is a predisposing factor of considerable importance. Payer²⁶ found that in a group of 300 cases nearly all of them developed a definite degree of gastric atony. The greater curvature was found frequently extending to the umbilicus or even below this. As a rule, this stomach paresis disappeared within from twelve to twenty-four hours. Especially interesting is Payer's statement that the severity of postoperative vomiting depends directly upon the degree of gastric atony that occurs. The critical period, he says, occurs on the third to the fifth day, when solid feeding is ordinarily begun.

Novak would have us distinguish two principal varieties of acute postoperative dilatation of the stomach, a primary and a secondary.

Primary.—Gastric dilatation, which is precipitated by operative procedures resulting in a disturbance of the innervation of the stomach, he characterizes as the primary variety. This is the type that many observers have actually seen on the operating table and it seems logical to assume that, in many instances, cases of so-called postoperative dil-

²⁴ Bull. med. de Paris, 1895, **9**, 809.

²⁵ Annals of Surgery, 1912, **55**, 615.

²⁶ Mitt. a. d. Grenzgeb. d. med. u. Chir., 1910, **22**, 411.

tation really had their beginning during the operation, at which time they were not detected. In such cases, the postoperative vomiting is construed as the usual postanesthetic emesis and it is not until the patient's condition becomes grave that the true nature of the trouble is appreciated.

Secondary.—He subdivides the secondary into septic and obstructive. (a) Septic; this is illustrated in the compound septic fracture of the femur to which we have previously referred. (b) Obstructive; obstruction of the duodenum by the upper border of the mesentery, Novak feels if it does occur, is almost always secondary to gastric dilatation.

TREATMENT.—The essential of successful treatment is the early recognition of the condition. Next in importance is gastric lavage. The stomach tube has saved the lives of many patients who have developed postoperative dilatation of the stomach. In order to emphasize the value of the stomach tube, Deaver teaches his students that the stomach tube has the same value to the surgical resident of a hospital as the stethoscope has for the medical resident. The frequency with which lavage is to be carried out depends upon the amount of gas and fluid evacuated. In many cases it is necessary at an interval of every two hours. Lavage instituted early gives very gratifying results, but when begun late usually proves of little avail. The postural treatment based upon what we now believe to be an erroneous theory of duodenal occlusion by the mesentery attempts to relieve this pressure by having the patient assume the prone or knee-elbow position, thus lifting the intestine and mesentery off the duodenum. The method is still employed and in some cases apparently gives definite relief, but, as it is practically always accompanied by gastric lavage, its real value cannot be determined. During the last two years we have encountered a great many cases of postoperative dilatation and, when uncomplicated by other conditions, have always been able to obtain relief by lavage alone and made no attempt to specify any posture.

Nikolai Paus and Margrethe Lorange²⁷ make an interesting report of their POSTOPERATIVE DEATHS occurring at the Tonsberg's Hospital, Norway. There was a mortality of 4.5 per cent in 1430 operations. The cause of death in acute disease was usually the disease itself or its complications. The same holds true about malignant tumors. In other chronic diseases death is often caused by other complications, such as pneumonia and embolism. Out of the 65 deaths, there were 3 caused by embolism of the lung, 2 by pneumonia, and 1 by postoperative infection in 735 operations upon chronic disease. There was only 1 case of pneumonia among the remaining acute diseases. This is quite a contrast to American statistics.

A similar report is found from Mandl²⁸ from the Second Surgical University Clinic of Vienna. He makes the observation, which has been previously referred to many times in American literature, that the further the point of intervention from the respiratory tract, the fewer the pulmonary complications. Thus, in 1379 abdominal opera-

²⁷ Norsk Mag. f. Laege Vidensk, Christiana, 1921, **82**, 322.

²⁸ Wien. klin. Wehnschr., May 5, 1921, **34**, 214.

tions there were 14.5 per cent having pulmonary complications. In 1585 operations on the head, neck, breast, rectum and extremities there were but 8.5 per cent of pulmonary complications.

TABLE I.

Author.	Operations.	Morbidity.	Morbidity per cent.	Mortality.	Mortality per cent.	Mortality per cent morbidity
Cutler and Morton (1), Mass. Gen'l.	3,490	65	1.8	33	0.94	50.7
Armstrong (2), Montreal Gen'l.	2,500	55	2.2	32	1.28	58.1
Mayo Clinic (3)	16,317	220	1.32	15	0.11	9.6
von Lichtenberg (4)	23,673	440	1.9			
Cutler and Hunt (5), Peter Bent Brigham	1,562	55	3.52	11	0.7	20.0
Decker, Pittsburgh	5,976	69	1.2	29	0.5	42.0

POSTOPERATIVE COMPLICATIONS OF THE RESPIRATORY TRACT.—Decker,²⁹ in speaking of the indifference to the postoperative complications arising from the respiratory tract, says one has only to consult such statistics as are found in Table I to be convinced that they are more frequent than is realized. Thus the morbidity varies from 1.2 per cent to 3.5 per cent, and the mortality from 0.1 per cent to over 1 per cent, which means that on an average 1 in every 45 cases operated upon developed a complication of the respiratory tract and that 1 in every 200 cases dies. In analyzing 5976 cases, they found that lesions of the respiratory tract do not occur more frequently in the vicinity of Pittsburgh than in other clinics. In analyzing the etiological factors, they consider them in two categories—exogenous and endogenous, depending upon whether they act from without or are due to the physical condition of the patient. The important exogenous factors are:

1. Anesthesia.
2. Exposure.
3. Type of operation.
4. Factors increasing the virulence of the bacteria.

The endogenous factors are:

1. Recent infection of the respiratory tract.
2. Local or general sepsis elsewhere.
3. General physical condition of the patient.
4. Condition of the cardiovascular system, predisposing to stasis in the lungs.
5. Thrombosis and the etiological factors upon which it depends.

As the result of their study, they believe that there is no constant or essential predisposing etiological factor in the production of respiratory tract lesions after operation, but that exposure of the patient and existing infection in the respiratory tract are quite as important as the setting free of emboli from the operative field, as Cutler³⁰ maintains in a recent article. Among the essential factors in the mortality he places infection first. In their series of 29 deaths, 18 were complicated with pyogenic foci. Shock and hemorrhage were associated in 3 cases. Again, in 16

²⁹ Pennsylvania State Medical Journal, 1921.

³⁰ Archives of Surgery, No. 1, vol. 1.

of their cases the respiratory tract complication was definitely the cause of death, and in probably 8 more was the factor which tipped the scales against the individual's recovery. Pneumonia and thrombo-embolism are the most prolific sources of mortality. Empyema is also highly fatal. Of the cases which may be considered potential risks, he considers there are three classes:

1. Those with a history of recent or acute respiratory infections.
2. Those with a history or evidence of chronic respiratory lesions, such as bronchitis and empyema.
3. Those with circulatory stasis.

Anesthesia.—We can also refer the reader to Wilensky's review of this subject in the June number of PROGRESSIVE MEDICINE, 1921, page 67. He has made a careful review of the method of *blocking the splanchnic nerves by local anesthesia*. Two methods are generally employed, that of Braun which approaches the nerves anteriorly, and that of Kappis which approaches them posteriorly. The German literature contains favorable reports by Priess, Ritter, Hoffman and Nölle. Practically no reports are found in the American literature this year. Preiss and Ritter³¹ report 2 accidents, 1 in which the vena cava was punctured and another in which the lung was injured. Paul³² also reports certain annoying effects which followed its use, such as pallor of the face, marked acceleration of the pulse, and often nausea which persisted for a long time. He also complains of being frequently handicapped by the short duration of the anesthesia. Others seem to be able to obtain an anesthesia lasting from a half to one hour. We do not feel that it has been sufficiently tried at the present time nor does it have any special advantages to warrant its replacing the well-known methods now at our disposal.

In the evolution of the practice of anesthesia, various combinations of the agents and numerous sequences have been employed which have modified, to a great extent, the unpleasant effects of the induction period, increased the efficiency during the course of the anesthesia, eliminated the period of nausea and depression during recovery, and Gwathmey³³ claims that, as a result, the safety of the administration has been nearly doubled. The statistics compiled by the Committee on Anesthesia of the American Medical Association for the years 1905 to 1912, in which are reported over a half million administrations, shows that sequences and combinations of anesthetics are safer and better from every standpoint than any one agent used alone. The mortality statistics published by this Committee are extremely interesting in view of our former figures. The mortality with straight ether, according to this table, is 1 death in 4533 cases; with sequences, the mortality of ether in one sequence was 1 death in 6424 cases, and with another sequence was 1 death in 10,007 cases.

When oxygen is used instead of air, with any general inhalation anesthetic, it adds to the immediate safety of the patient, as well as

³¹ Zentrbl. f. chir., 1919, No. 3, 46.

³² Weiner klin. Wochschr., 1920, 47, 33, 511.

³³ Journal of the American Medical Association, August 6, 1921, No. 6, 77, 421.

to his subsequent comfort. The same can be said when any one of the agents employed is heated to the temperature of the body. The addition of oxygen to nitrous oxide renders the postoperative condition more comfortable, increases the safety to such an extent that no one would be held blameless who did not use this precaution. On the other hand, the administration of nitrous oxide and oxygen without the addition of other agents is positively dangerous, and the mortality is high. Unquestionably, a patient's condition is better after the administration of nitrous oxide and oxygen, with small amounts of ether (from 1 to 4 gm.) than when saturated with ether.

Gwathmey believes that it is possible, by utilizing the synergistic action of magnesium sulphate with morphine, to obtain a safer form of anesthesia with equally good relaxation, with less nausea, vomiting and depression than when ether is used with nitrous oxide oxygen. Ether is thus absolutely eliminated. To the late Samuel J. Meltzer is due the credit of having discovered the anesthetic properties of magnesium sulphate. True, he attempted to use it alone, as ether and chloroform were first used, and did not entirely succeed. Gwathmey claims that magnesium sulphate with morphine synergizes the nitrous oxide and oxygen, and, if used with ether, it will reduce the amount required by one-third to one-half. Magnesium sulphate is claimed to have no deleterious effects on any of the tissues or organs of the body, and, when used as a synergist, has no toxic effect whatsoever on the respiratory center. It seems to act mechanically with morphine, holding this drug in contact with the tissues longer than it is able to maintain such contact alone; while with ether, and also with nitrous oxide and oxygen, it acts by deepening or increasing the effect, rather than by prolonging it. Hence, when used with morphine, the same dosage is employed, one dose, however, relieving pain for from ten to thirty hours instead of from two or four hours. But when it is used with ether the dosage may be cut one-third or one-half; when used with nitrous oxide and oxygen, the oxygen may be considerably increased and the nitrous oxide decreased.

Gwathmey further details this new use of magnesium sulphate, as follows: One and a half hours before the operation a hypodermoclysis is aseptically given, consisting of 200 to 400 cc of a sterile and chemically pure 4 per cent solution of magnesium sulphate at a temperature of 110° F., the solution running in by gravity in not less than thirty minutes. Fifteen minutes after the hypodermoclysis has been started, the first hypodermic of $\frac{1}{8}$ gr. of morphine in plain water is given. This is repeated at intervals of fifteen or twenty minutes, until $\frac{3}{8}$ gr. is given to the average adult. If an idiosyncrasy is present, it will develop before the time for the third dose. Quite often $\frac{1}{4}$ gr. is ample, especially for women. The room should be darkened, and quiet maintained, or the bed screened and a towel placed over the patient's face, and the patient should be transferred to the operating-room with as little disturbance as possible. When ready, the mask is applied to the face and the oxygen started at the same time as the nitrous oxide. Cyanosis should not be tolerated at any time as the gases are used only to com-

plete the analgesia and to render the patient unconscious. The oxygen may be rapidly increased up to 35 or even 50 per cent. A continuous administration is the most satisfactory method. Gwathmey concludes that with magnesium sulphate, morphine and nitrous oxide oxygen, a state of general analgesia can be maintained with relaxation almost indefinitely, without any deleterious effects.

Not having any personal experience with this mixture or synergizing group of anesthetic agents, we hesitate to offer any criticism, but at the same time we are just as careful to withhold our approval. To be able to maintain a state of general analgesia with relaxation for almost indefinite periods without any deleterious effects has not been possible in the past, and it is a big task, to say the least. Time and experience will be necessary to place the proper value upon this statement.

Gwathmey and Greenough³⁴ make a later report upon this subject entitled, "A Clinical Experience with Synergistic Analgesia." It is a review of 16 cases in the service of Adrian Lambert, and they quote Lambert as saying "the relaxation with nitrous oxide oxygen and the synergists is just as good as without nitrous oxide oxygen and ether." We take it to mean that relaxation is just as good as with nitrous oxide oxygen and ether. They conclude in this report:

1. That morphine and magnesium sulphate synergistically used give good relaxation when supplemented with: (a) nitrous oxide and oxygen, to abolish consciousness and for its added analgesic effect; (b) or by using a local analgesic for the skin and peritoneum.

2. Nausea and vomiting, wound and gas pains are reduced to a minimum and are quite often entirely eliminated.

3. When morphine is given as a preliminary to any inhalation anesthesia, its good effects are observed during the period of induction, when it almost entirely abolishes the stage of excitement. But it has no effect upon the nausea and vomiting which occur as the patient emerges from the inhalation anesthesia. This is a more conservative statement than most advocates of morphine make, for it is generally claimed that the preliminary use of the drug definitely lessens the incidence of postanesthetic nausea and vomiting. But Gwathmey claims that this nausea and vomiting can be entirely avoided by using magnesium sulphate.

4. Morphine and magnesium sulphate will give relief from pain not only postoperative but at all times, and for a much longer period than when morphine is used alone.

SPINAL ANESTHESIA.—Spinal anesthesia was reviewed last year, and Well's report of the method of Delmas was given in detail.

Its Dangers.—Guibal,³⁵ for a long time an ardent advocate of spinal anesthesia, is now convinced that it is not the ideal method surgeons had hoped and he makes a plea that surgeons publish their bad results and describe them in sufficient detail to bring this question to a sane solution.

³⁴ Annals of Surgery, August, 1921, No. 2, 74, 185.

³⁵ Presse Medicale, March 26, 1921.

Action of Spinal Anesthesia on the Function of the Liver and Kidney.—Rannueci,³⁶ in a study of 67 cases varying in age from sixteen to seventy-four years and who had every variety of operation, concludes that spinal anesthesia has practically no action on the liver or kidneys and that, in patients suffering from renal or hepatic insufficiency, spinal anesthesia is a much safer method than general anesthesia.

In this country, at least, spinal anesthesia seems to be making slow progress in replacing general anesthesia.

LOCAL ANESTHESIA.—Bartlett³⁷ confines himself to consideration of three methods. (1) Direct infiltration of the field; (2) circular infiltration about the field; (3) nerve blocking, in which the agent is injected directly around or into an isolated nerve.

In reviewing the *psychological aspects* he makes the statement that public appreciation of local anesthesia is secondary in importance only to the intrinsic value of the procedure itself. There is, in different patients, a marked variation in receptivity to pain stimuli which is largely influenced by race, nationality, sex, age, intelligence, character, training, state of health, fatigue and surrounding influences. Nor is it pain alone which we have to control; the problem is, at the same time to combat the anticipation of pain and the age-old fear of pain; not only does the surgeon have to deal with the patient, but with the patient's viewpoint.

A convincing effect upon a prospective local anesthesia patient is obtained by allowing him to talk with one who has passed through the experience. Bartlett feels that this does more than anything else to inspire confidence in the method. It has a certain appeal to patients who have had a general anesthetic, not only from the personal unpleasantness but to many the taking of a drug which is so potent as to render them unconscious, probably has more or less permanent influence upon vital functions. The attitude of people about remaining awake on the operating table varies. While one may claim that they do not want to know anything about the operative procedure and cannot bear the thought of being awake in an operating-room while being cut, others are just as positive that they do not wish to lose consciousness for a single moment and want to know what is going on, even at the expense of some pain. Here, as elsewhere in medicine, every patient is to some extent a law unto himself and demands individual treatment.

Local agents act as anesthetics because they are soluble in the lipoids of the peripheral nerves, and most experimenters consider their action to be physical rather than chemical. They have a special affinity for sensory nerves, affecting them earlier and much more profoundly, and for a much longer time than they do the motor variety. All of the local agents, in addition to being protoplasm poisons, are at the same time toxic in a general sense by their effect on medullary centers; they are dangerous in proportion to the dose used and to the rapidity of absorption. Their general toxicity may be inhibited by anything which retards absorption, *viz.*, cold, constriction, or the admixture of adrenalin.

³⁶ Polyclinico, Rome, March 7, 1921, **28**, 324.

³⁷ Surgery, Gynecology and Obstetrics, July, 1921, p. 27.

The respiratory center in the medulla is the first to suffer, and the one most deeply affected, hence prolonged artificial respiration may, in some instances, be the means of saving life.

Experiments seem to show that *novocaine*, now produced in this country under the name of procaine, is the agent of choice. It is about one-tenth as toxic as cocaine; it is non-irritating and produces no tissue damage. In his experience he has observed no difference between the effects of 0.5 to 0.25 per cent novocaine when used by infiltration, though this does not agree with the observations of other clinicians.

The effect of local anesthetics upon the different tissues, of course, is variable. The skin is the most sensitive of all structures and particularly that of the finger-tips, while the least sensitive portion of the skin is that covering the back. Muscle sheaths are highly sensitive, while muscle itself is much less so, as also is fat. Periosteum is acutely sensitive in areas which lie superficially beneath the skin, but, curiously, it is less sensitive in other parts of the body. The nerve supply of bone comes from the periosteum, hence bone sensation is largely dependent upon the treatment of the periosteum; indeed, bone is said to be practically anesthetic if the periosteum has been removed. Inflammatory affections makes all tissues acutely sensitive to the injection of local anesthetics as they would be to any other form of trauma. Edema, on the other hand, usually decreases tissue sensibility.

The *advantages* he enumerates as follows: The coöperation of the patient, as in the use of the voice during thyroidectomy; the lessening of operative shock by cutting off of all centripetal stimuli from the cerebral centers; a refining influence upon the operator's technic, since crude, rough work cannot be done without a general anesthetic, and, finally, he feels that there is a great reduction in the mortality by the resulting decrease in postoperative pneumonia and parenchymatous degenerations. Among the indications for local anesthesia he speaks of, first, the ability and inclination of the surgeon, together with the attitude, age, race, training and intelligence of the patient. It can be considered as indicated in obstructive conditions of the air-passages, and in inflammatory affections of the respiratory tract, circulatory decompensation, acute abdominal emergencies, renal insufficiency, toxic conditions, such as goiter, and very old age.

Contraindications include patients of an age when they cannot coöperate with the surgeon, young children or those in which there is an unreasoning fear of it. He also hesitates to use it alone for the performance of an operation which goes beyond the ordinary time limits.

The *technic* includes, first, the psychology of the patient: Mental control by diverting his attention to other subjects; an absolutely quiet room; the diverting smoking of a cigarette; the hard table and uncomfortable posture or fatigue are usually more important factors to the patient than the injection itself.

In the preparation of the fluid, he emphasizes the following precautions. It must be fresh; it must not have been boiled more than once; the adrenalin must always be added and never boiled; also, the adrenalin is always decomposed if it is added while the solution is very hot;

physiological salt solution must be used as a vehicle, the water of which must be freshly distilled. Bartlett suggests the freezing of the skin with a spray of ethyl chloride solution in order to make the preliminary superficial wheal for the introduction of the larger needle painless. The size of needle varies with the work. A 10- to 20-cc syringe, with a 3-inch, 22-gauge needle meets the requirements for the average work. He advocates direct infiltration of the incision line in every hyperesthetic individual or whenever it is necessary to save time. *Circular infiltration* is employed in the treatment of malignant diseases. One should not, of course, risk metastasis by inserting a needle into the immediate vicinity of any such lesion. The same method is employed in the treatment of any acutely inflamed area, as a carbuncle. Direct infiltration of such tissues is just as painful as the incision itself, and may further increase tension in an acutely inflamed area and thus result in the opening up of new fields of infection.

The employment of nerve blocking requires, of course, a knowledge of peripheral nerve anatomy. The desired nerve is identified by the paresthesia created when the needle-point strikes it, or using an insulated needled and electrical stimulation of a mixed nerve, causing a contraction in the muscle supplied by it. An injection of a few cubic centimeters of a 1 or 2 per cent novocaine-adrenalin solution creates a complete anesthesia in from fifteen to thirty minutes, which lasts for something like two hours. The blocking of the third or fourth cervical nerves at the points where they issue from between the vertebræ is simple and gives so perfect an anesthesia over the front and sides of the neck that any operation in this region can be performed. Thyroidectomy, performed under such anesthesia, is remarkably satisfactory. Of course, there is some theoretical risk in making such an injection on both sides of the neck at once, namely, the blocking and putting out of commission of both phrenic nerves, which would result in immediate death. For major operations upon the chest wall, infiltration anesthesia has given him the best results. He does not recommend its use for amputation of the breast which requires a blocking of the brachial plexus, practically all of the dorsal nerves and the creating of an enormous barrier around the entire field, a procedure so difficult and time-consuming as to practically double the surgeon's work and the patient's load. In abdominal surgery his experience convinces him that a combination of local, regional and partial general anesthesia are necessary since one has to deal with cerebrospinal nerves, as well as with the sympathetic and vagus. Nothing is simpler than to get through the abdominal wall with one of the forms of infiltration or nerve-blocking anesthesia. But the parietal peritoneum outside of the affected area is extremely sensitive, while traction upon any viscous in the abdomen causes such suffering as to make the patient uncontrollable. The fact that Pauchet finds it necessary to inject twenty-two dorsal and lumbar nerves in order to surely anesthetize the abdominal wall and its contents, when working on both sides of the midline, clearly indicates the advantages of general anesthesia under such circumstances. Bartlett's practice in abdominal work is the giving of a preliminary $\frac{1}{4}$ grain of morphine thirty minutes

before the operation, and, after the patient is entirely prepared on the table and everything ready for the operation, ether anesthesia is begun and the infiltration started at the same time. By the time the wall is infiltrated and the opening made, the patient has sufficient ether to allow exploration of the abdomen, packing off and drawing up into the incision the desired viscous; then the ether is discontinued. This is regarded as the first peak of the operative procedure; when the ether is discontinued the patient frequently weakens, but rarely moves during the progress of the manipulation, provided, of course, no pushing or pulling occurs. He is able to stand a normal pain under the slight influence of morphine, novocaine and residual ether until the second peak is reached which in this instance would be the removal of the abdominal pack, when it is absolutely necessary to give a second small dose of ether. If the anesthetist is given a minute's warning, the whole procedure goes smoothly and there is no break. After the packs are removed, the ether is permanently discontinued and the abdomen is closed, the novocaine infiltration sufficing to make the closure absolutely painless. As a consequence, the abdominal walls are relaxed, and there is never at any time the forced respiration which makes it so difficult to approximate the deeper abdominal layers of a patient who is stimulated by ether or cyanotic from its use, and subconsciously fighting for air.

ETHYL CHLORIDE.—References to the use of ethyl chloride as a general anesthetic are increasing each year, and though we have in the past discouraged its use except by those experienced in giving it, we admit that it is "a very useful anesthetic agent, but like the racing automobile, it should not be handled by a novice". It probably is becoming more and more frequently employed for short anesthesia and its action is so rarely understood by many who employ it, that Geudel's³⁸ article will be reviewed.

It is the most rapid and powerful single anesthetic known, except ethyl bromide which is rarely used at the present time, and, when not properly handled, death will ensue from passive asphyxia, the heart stopping in from one to four minutes after the cessation of respiration.

With an overdose of ethyl chloride, two entirely different sets of symptoms may occur. Four out of five will exhibit the muscular spasm type of poisoning, while the fifth will manifest the respiratory depression type.

Muscular Spasm Type.—With the too rapid administration of ethyl chloride to the point of overdosage, the patient will at first show clonic, which will be followed immediately by tonic spasm of the muscles of the face and throat. There will appear a curious sardonic grin, accompanied first by tonic spasm of the masseters, locking of the jaws with unbelievable rigidity. About the same time there occurs a crowing respiration due to laryngo-pharyngeal spasm. With the continued administration of the agent, respiration becomes more embarrassed by the progressively increasing spasm of the throat muscles, until it is

³⁸ Indianapolis Medical Journal, November, 1920.

cut off as effectively as if the trachea were completely constricted, and a definite state of asphyxia results. Under these circumstances, it is extremely difficult to open the mouth, and the patient may die before this is accomplished. Death in such a case is due to active asphyxia. This spasm may occur in any type of patient. There is no way to determine before the administration of the anesthetic what will occur. If the anesthetic is given by a novice, it is wise to insert a mouth gag before starting.

Respiratory Depression Type.—The incidence of this type is less frequent, and, while more alarming in the beginning, it is easier handled if the anesthetist is alert.

At any time during the anesthesia—usually late, however—the respiration insidiously becomes quietly and progressively shallower until it ceases altogether. This takes about twenty to forty seconds.

The picture is one of fatal shock, with extreme pallor, wide open, staring eyes with completely dilated pupils, absolute muscular relaxation, and with no effort whatsoever at respiration. Curiously, at this stage the pulse shows no change. Removing the mask, artificial respiration is started at once, making sure that there is a passage of air into and out of the lungs. The ethyl chloride is so rapidly eliminated from the circulation that but a few artificial respiratory movements are sufficient to allow the excess gases to be carried from the medulla and spontaneous respiration is again inaugurated. Again, there is no particular type of individual in which this phenomenon occurs. Like the spasm, it must be watched for, and when it occurs, treated accordingly.

ANESTHETIC UNITS OF MEASUREMENT.—Miller³⁹ raises a very important question of standard anesthetic units by which anesthesia should be measured. In local anesthesia instead of speaking of percentages he suggests the unit of measurement should be the weight of the drug administered. In nitrous oxide oxygen anesthesia the routine measured dosage, of course, is used, and he feels that its present success is largely due to this procedure. The determination of a unit of measurement for the volatile anesthetics, of which ether is the most prominent example, is a much more difficult problem. The boiling-point of ether is 2.5° F. below the normal body temperature. It follows that, while under ordinary condition ether is a liquid, at the temperature of the body it is a vapor and has expanded to about three hundred times its liquid volume. The rate of vaporization of ether is variable, depending, at atmospheric pressure, upon the rate of renewal of the atmosphere, the extent of the evaporating surface, and the temperature of the liquid ether. As vaporization goes on, the liquid ether steadily becomes colder and the rate of evaporation steadily decreases. Pure ether vapor is practically irrespirable and is never used for anesthetic purposes; instead, a mixture of ether vapor with air is administered. The mixture of ether vapor and air is formed in one of two ways. Usually a current of air is passed over the surface of liquid ether. The steady reduction in the tempera-

³⁹ Journal of the American Medical Association, August 6, 1921, No. 6, 77, 433.

ture of the liquid ether due to evaporation results in the constant diminution in the rate of vaporization, and a constantly declining percentage of ether vapor in the mixture. The attempt to regulate exactly the dosage of ether by diluting the mixture with a known percentage of air must fail on account of the constantly decreasing percentage of ether vapor in the original mixture.

In the second method, known amounts of ether are ejected into the current of air. If the flow of the air current is also measured a very accurate measurement of the strength of the vapor may be obtained. It is evident, ether can be administered with greater regularity and precision by a mechanical apparatus than can possibly be administered by hand, and Miller describes an apparatus which for the first time makes use of a new principle, the keeping of ether at a constant temperature (Fig. 1). Liquid ether is placed in a container partially filling it and kept at a constant temperature by means of an electric thermostat. The space remaining in the container becomes filled, under these conditions, with ether vapor of a constant tension, the

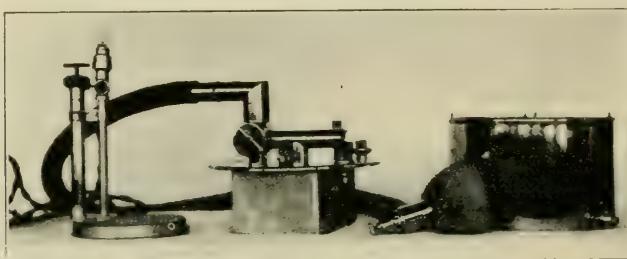


FIG. 1.—The constant temperature ether vaporizer. From left to right: heater and thermostat, ether chamber, inhaler, water bath. (Miller.)

tension depending on the temperature of the liquid ether. The container, which is twelve inches long, two inches wide and three inches deep, is submerged in a water-bath. Openings are placed at each end of the container on its upper aspect, and in one of these is mounted a three-way graduated valve, by means of which the saturated ether vapor, as it is withdrawn from the container, is diluted with air to any desired percentage. An outwardly opening check valve controls the exit of the vapor from the container, and an outwardly opening valve for the expiration is mounted on the inhaler. The unit of measurement is the tension of the ether vapor in the container. The dosage is indicated in percentages of this tension. With the thermostat set for 90° F. the average patient is anesthetized with a 50 per cent mixture after the induction period has been passed. The apparatus is very economical, using about 4 fluidounces of liquid ether during the first hour's anesthesia. In discussing this report, Rapoport favorably commented upon the apparatus from the standpoint of the anesthetist, and we can sympathize from personal experience when he says that after three or four cases of anesthesia he himself suffers from the absorption of ether.

If some method can be devised, by which the patient can be given a definite amount of ether and the anesthetist not be given any, the advantages will work both ways. In measuring the anesthetic when given by the usual open-gauze method, it is inevitable that at least one-half of the ether applied shall be wasted, but, if care be taken to avoid all unnecessary waste and a uniform method is used with each case, a satisfactory measured dosage may be obtained with the open method by measuring the volume of liquid ether applied to the gauze. The unit of measure is in volume of ether rather than in weight, because the volume is more easily measured.

AMOUNT OF ETHER USED IN THE INHALATION METHOD OF
ANESTHESIA.

	Average.	Fluidounces of ether	Minimun.	Maximum.
First 5 minutes	1.95	1	2	
First 10 minutes	3.06	2.5	4	
First hour	9.64	.7	16	
Second hour	4.0	1	8	

BLOOD-PRESSURE GUIDES DURING ANESTHESIA AND OPERATION.—From a review of hospital reports, Miller⁴⁰ estimates that from 15 to 45 per cent of the postoperative mortality is ascribed to surgical shock. Considering the accepted value of blood-pressure tests in detecting or anticipating shock, Miller advocates requiring a routine blood-pressure examination in each operative case. The systolic and diastolic pressures should be taken by the auscultatory method prior to the operation, and at five- or ten-minute intervals during the operation, and as frequently following the operation as the patient's condition indicates. The blood-pressure readings will warn of the effects of surgical trauma, hemorrhage, danger from a damaged heart, effects of respiratory obstruction, exposure of viscera, sudden changes of posture and the effects of the anesthesia.

ETHER OIL (COLONIC ANESTHESIA).—Wilensky, in his review of anesthesia in PROGRESSIVE MEDICINE, June, 1921, observes that this method seems to be growing in favor in experienced hands in America. But one gets the impression that it is losing favor with the foreign surgeons. Its use in America is largely due to the enthusiastic work of Gwathmey and the attractive way in which he has presented it to the profession. It will be interesting to see the relative values he places upon ether-oil colonic anesthesia and the nitrous oxide-oxygen-magnesium sulphate synergistic analgesia which we have reviewed above. We cannot entirely approve of ether-oil colonic anesthesia from our own experience.

Horsley⁴¹ warns against its use when the liver is diseased. By this method the ether is absorbed through the portal circulation and concentrated in the liver. If the liver is crippled, unfortunate results have occurred. Our personal objections to the method are offered with

⁴⁰ American Journal of Surgery, April, 1921, **35**, 34.

⁴¹ PROGRESSIVE MEDICINE, June, 1921, p. 69.

hesitancy when our experience is compared with that of Gwathmey. However, the inability to quickly control the dosage of the anesthetic agent, as one is able to do in all inhalation methods, is our serious criticism. With all forms of inhalation anesthesia the dosage can be varied from minute to minute as the conditions require. In ether-oil colonic anesthesia a definite dosage is given for the estimated anesthesia required. Estimated before the operative procedure begins, and though the depth of anesthesia may be varied to a slight extent by changing the amount of air inhaled, it cannot be quickly stopped as is so often necessary during an unforeseen emergency. True, the rectum can be emptied by enemata, but the ether in the portal circulation and liver cannot be removed except by passing from the circulating blood out through the air-passages. We have encountered this emergency when it was being given by one of the most expert of anesthetists, and with a fatal result. We are convinced that it should only be used by those experienced in its administration; even then, we do not feel that it is as safe as inhalation anesthesia.

NITROUS-OXIDE ANESTHESIA.—Wilensky⁴² reviews McKesson's suggestion of secondary saturation of the tissues with nitrous-oxide gas to produce sufficient relaxation in refractory cases. In the *Journal of the American Medical Association*, April, 1921, **35**, 43, he refers to the use of the primary and secondary saturation of the patient with nitrous oxide previous to the proposed operation in order to determine the patient's resistance to shock. Primary and secondary nitrous-oxide saturation, at one phase increases the pulse-rate, and immediately following decreases the pulse-rate and blood-pressure. When the oxygen reaches the blood stream, after the period of nitrous-oxide saturation, the pulse-rate and blood-pressure return immediately to their former readings in normal cases. In the moribund cases, however, there is usually circulatory depression of a more or less serious degree to begin with, and the depression following primary nitrous-oxide saturation will not recover after oxygen is given as in the normal case, but it will continue and at times even deepen for over a period of three to five minutes. This abnormal response to the test contraindicates any but extremely short and simple operative procedures. A still more searching test is needed to determine the degree of reserve or compensatory power in questionable cases and for this purpose McKesson produces primary and then secondary nitrous-oxide saturation, noting the effect of each on the pulse-rate and blood-pressure relations for three to five minutes after reoxygenation. If the pulse is increased as much as 25 per cent and the blood-pressure decreased 25 per cent or more, and the patient, while inhaling oxygen, is unable to compensate within five minutes, McKesson has found that he is absolutely inoperable, even in the hands of the best organization of surgeon, anesthetist and assistant.

EFFECT OF NITROUS-OXIDE-OXYGEN ANESTHESIA ON ANIMALS INFECTED WITH TUBERCULOSIS.—Rogers⁴³ reports investigations upon the effect of nitrous-oxide-oxygen anesthesia upon guinea-pigs infected

⁴² PROGRESSIVE MEDICINE, June, 1921, p. 70.

⁴³ American Medical Journal of Surgery, April, 1921, **35**, 44.

with pulmonary tuberculosis. We attempted several years ago the same problem, using ether, but were unable to arrive at any definite conclusions because of the high mortality of the pigs from the tuberculous foci in other parts of the body. Rogers concludes, from his investigations, that the daily administration of nitrous-oxide-oxygen anesthesia to guinea-pigs suffering with pulmonary tuberculosis does not influence the development of the disease, and that neither is it detrimental to the general health of the animal. From the fact that these gases do not cause such labored respiration and are less irritating than ether, he considers them more suitable for anesthesia in all infections of the respiratory tract.

Gallupe⁴⁴ reports upon the administration of ETHER INTRAVENOUSLY. He says it is without danger when controlled by one who understands the physiological effects of ether (and we would add the method of its administration), and when used on a patient with a relatively low blood-pressure. It is a method employed by the Germans for many years. Though it has not been adopted by surgeons, it appeals because of its accuracy of dosage, complete control and direct method of introduction into the circulation. At least it would seem to be an ideal method for experimental work upon animals.

A man, aged sixty-six years, with marked alcoholic habits, was given in all 70 cc of ether, dissolved in about 1 liter of isotonic salt solution at room temperature. A sterilized glass burette, with rubber tubing and cannula, were used to introduce the ether into the median basilic vein into which the cannula had been inserted under local anesthesia. At first, 5 cc were run in per minute; this was increased to 10, when the patient became happy and ether could be detected on his breath. The flow was then increased to 15 c c per minute, when he became suddenly unconscious, his respiration regular and deep, his muscles completely relaxed, and all reflexes disappeared except the pupillary. As long as the flow was maintained at 15 c c per minute, this state remained unchanged, but with a decrease in the amount there was a rapid return of reflexes and an increase was followed by shallow respiration, a rise in pulse and a widely dilated pupil. At the beginning of the operation, a Lombard airway instrument was inserted into the patient's mouth. When the skin was sutured, the flow was stopped after about 1200 c c of the solution had been used. Within about ten minutes after the ether had been discontinued, the man was conscious and rational, and without nausea.

ANESTHETICS IN THE PLASTIC SURGERY OF THE FACE AND JAW.—Rowbothom and Magill⁴⁵ report the result of their experience with 3000 anesthesias administered in operations upon war injuries at the Queen's Hospital, Sidcup. The character of work at this hospital has attracted the attention of all surgeons, and such a report as this one can be looked upon as authoritative. The preliminary use of $\frac{1}{6}$ grain of morphine and $\frac{1}{30}$ grain of atropine was considered necessary to minimize the secretion of mucus. The choice of anesthetics was divided between

⁴⁴ Boston Medical and Surgical Journal, May 12, 1921, 184, 495.

⁴⁵ Proceedings of the Royal Medical Society, March, 1921, 14, 17.

ether an gas-oxygen-ether. The patient's general condition, both during and after operation, was better when gas-oxygen-ether was employed. Of the methods of administration, insufflation was by far the most valuable, and used in fully 9 out of 10 cases. Rectal oil-ether was used for a time, but eventually abandoned, not only because of the uncertainty of its effects and the tedious preparation required, but because the same difficulties of maintaining an airway were encountered and had to be overcome as when the patient was anesthetized *via* the respiratory passages. That they should have but 4 cases of bronchitis and 2 of pneumonia in a group of 1700 cases operated upon, during the period of twelve months, is unusual. One of their explanations is that it was due to the fact they were operations of election, and were always postponed if a patient had any respiratory infection.

INTRATRACHEAL ANESTHESIA.—A method of intratracheal anesthesia by the nasal route for operations on the mouth and lips is described by Rowbotham.⁴⁶ A catheter with a special eye is passed through the nose, the nasopharynx and oropharynx into the trachea. The catheter is guided into the trachea by a rod which directs it through a laryngoscope of the type used by Jackson and Hill.

Tetanus.—Ashhurst, A. P. C.⁴⁷ believes that tetanus is a pure toxemia, and that, unless toxins are formed, the bacilli of tetanus or their spores may be present in the tissues without causing any symptoms. Experimentally, small animals develop a form of tetanus known as "tetanus ascendens." The disease begins in the inoculated extremity, and, though other neighboring parts may become affected later, death or recovery usually occurs before trismus and the retraction of the head appear. Before any other symptoms appear in man and the larger animals, contractures of the muscles of the neck and the jaws usually begin, irrespective of the point of inoculation. Later, the back and then the muscles of the extremities become involved. To this form of the disease "tetanus descendens" is applied.

The bacillus of tetanus normally inhabits the intestinal tract of horses and cattle and is deposited with their excretion. It is also found in the intestinal tract of man in about 5 per cent of cases. The growth of the organism is favored by anaërobic conditions, thus, contused, lacerated, and gunshot wounds offer ideal conditions.

The treatment of tetanus consists essentially in its prevention, and the first step in its prevention is adequate surgical care of the wound. Every wound of this type should first have a mechanical débridement, a chemical disinfection and the prophylactic use of antitoxin. The mechanical and chemical treatment of the wound is now so standardized that Ashhurst does not discuss it. The prophylactic use of antitoxin requires a knowledge of: (1) The quantity that should be administered; (2) the site of injection; and (3) the frequency with which the antitoxin should be given. The usual prophylactic dose is now considered to be 1500 units, but the amount of antitoxin required to prevent death increases in a geometrical progression with the time elapsing after the

⁴⁶ British Medical Journal, 1920, **2**, 590.

⁴⁷ Archives of Surgery, 1920, **1**, 407.

receipt of the injury. Ashhurst prefers to inject it intramuscularly in the immediate vicinity of the wound in order to flood these tissues before the process of absorption of the toxin has begun, and this prophylactic injection should be given as soon as possible after the receipt of the wound. It cannot be denied that tetanus does develop after the prophylactic use of antitoxin, but when this does occur the interval is much longer than usual, the symptoms much less severe and death is very unusual. He emphasizes that a distinction should be made between late tetanus (that type in which the primary attack does not develop until after a lapse of four weeks), local tetanus (corresponding to the experimental form known as "tetanus ascendens," but this never becomes general in man as it does in the smaller animals), chronic tetanus (which is of long duration, relatively mild and sometimes leaves contractures), and recurrent tetanus (in which the primary attack is followed by recurring ones).

Ashhurst believes that until the uselessness of serum in preventing late tetanus is proved, surgeons should administer antitoxin at each operation upon wounded tissues, especially if there has been a foreign body retained or a dense cicatrix exists. He outlines the indications for the treatment of tetanus as: (1) The removal of the source which supplies the toxin; (2) to neutralize the toxin already formed; and (3) to depress the functions of the spinal cord.

Removal of the source is a mechanical surgical problem, débridement, drainage of the wound and exposure of the tissues to the oxygen of the air.

In neutralizing the toxin, it is essential, of course, that the maximum quantity of antitoxin should be introduced as soon as possible. Thus, at the first administration about 20,000 units are given, distributed between the muscles immediately surrounding the wound, the intraspinal injections, and intravenous injections. The intraspinal injections should be repeated every twenty-four to thirty-six hours until improvement is noted. The intravenous injections need not be repeated for several days unless the patient does not improve, when the original amount should be repeated within twenty-four to thirty-six hours. For intravenous injections, Ashhurst is convinced that the undiluted serum is injurious because of the likelihood of producing thrombosis and embolism. He dilutes his serum with a saline solution up to a total quantity of about 500 cc. The depression of the function of the spinal cord consists in the administration of chloral, bromide and magnesium sulphate. Ordinary doses are not sufficient, but care must be taken to avoid overdosage, as deaths have occurred in this way. In conclusion, Ashhurst emphasizes that the patient should be treated as well as the disease. In our hospital experience we feel certain that this is a very common error, and that a certain proportion of deaths are due to an oversight of this kind.

Freedlander⁴⁸ reports 4 cases of tetanus in which large amounts of antitoxin were given intravenously.

⁴⁸ American Journal of the Medical Sciences, June, 1921, No. 6, 161, 819.

1. The antitoxin was given in dosages of 10,000 to 20,000 units, intravenously, several times daily until all spasms had disappeared.
2. Morphine hypodermically and chloretone were given every four to six hours by rectum during the stage of reflex hyperexcitability.
3. Liquid nourishment and large amounts of water were given every two hours.

The most important factor in the prognosis of tetanus is the incubation period. Freedlander's 4 cases were as follows: Case 1, seven days; Case 2, twenty-four days; Case 3, eleven days; Case 4, twelve days. Thus all but one case were within the Hippocratic period of comparative safety, namely, ten days. In our review of 1920, we referred to Robertson's work which would seem to point to at least a partial conduction of the toxin by the lymphatics. Therefore, as a basis for therapy, it is safest to take the position Robertson assumes, namely, that tetanus toxin appears in the blood stream and other tissues, and can be neutralized by antitoxin at any stage of its passage before its final and relatively undissociable union with the ganglion cells. Consequently, the greatest indication for treatment would seem to be to maintain as high a concentration of antitoxin in the blood and lymph stream as possible.

LOCAL TETANUS.—Last year we referred to the many reports in military literature of this phenomena of local tetanus. Taylor⁴⁹ reports a case in civil practice which deserves reviewing.

A schoolgirl, aged seventeen years, received a compound fracture of the humerus following a fall. The wound was immediately closed by suture by a local physician, but signs of infection developing three days later the child was brought to the hospital, when diagnosis of gangrene incident to traumatism of the brachial artery was made. The arm was amputated four inches below the shoulder. The flaps were unsutured and Dakinized. Through miscarriage of orders, antitoxin was not given. Three days later, and six days after the injury, the patient complained of slight pain and stiffness in the neck; on the thirteenth day there were cramps in the right shoulder. On the fourteenth day after the injury, the stump of the amputated arm was found to be rigid, and there was pleurothotonus toward the left side of amputation. On the sixteenth day there was spasmotic twitching of the stump which was very painful. On the seventeenth day the twitchings becoming more frequent, almost every half minute. A positive diagnosis of tetanus was made. It was furthermore determined at this time that antitoxin had not been given. Ten thousand units of antitoxin were given intraspinally and a like amount intravenously. This was followed by the subcutaneous injection every twelve hours of 5000 units. Large doses of chloral hydrate, chloretone and luminal were used, and a somnolent condition was maintained. It was found that luminal alone, in doses of 0.1 gm. every night, was sufficient to maintain this state. On the nineteenth day, 10,000 units of antitoxin were given intravenously. On the twenty-second day there was decided improvement. No more antitoxin or luminal was given after the twenty-fifth day. A total of 115,000

⁴⁹ Annals of Surgery, August, 1921, No. 2, 74, 110.

units of antitoxin was administered, of which 20,000 units were given intravenously, 10,000 units intraspinally and the remainder subcutaneously.

Local tetanus was considered a rare occurrence before the war. Demontmerot⁵⁰ reported 4 cases of "paraplectic tetanus," of which only one can be properly classified as local tetanus. Axhausen,⁵¹ in an analysis of 11 cases, believed only one to be truly localized. A few single case reports appeared up to the time of the war when the number greatly increased, and among the French caused such interest as to justify the publication of the book on abnormal forms of tetanus by Courtois, Suffit and Giroux.



FIG. 2.—Contraction of the neck and shoulder muscles simulating opisthotonus.
(Taylor.)

Etienne⁵² ascribes the great frequency of local tetanus after-war wounds to the fact that the prophylactic injection is able to neutralize the toxin circulating in the blood stream and thus prevent general manifestations. Francais⁵³ offers the explanation that the antitoxin cannot affect the toxin already combined with the nerves and therefore has no effect on the local tetanus while preventing the development of general tetanus.

⁵⁰ Thèse de Paris, 1904.

⁵¹ Deutsch. Zeit. f. Chir., 1905, **78**, 265.

⁵² Paris Medical, 1918, **8**, 91.

⁵³ Ibid., **8**, 255.

Bruce,⁵⁴ in his tabulation of 1458 cases occurring in the British Home Military Hospitals during the war, states that 201 of these were examples of local tetanus. Also that the ratio of local tetanus to cases of general tetanus tended to become higher each year as the war progressed. This he explains by the increased use of antitoxin and also to an improvement in the diagnosis of mild and obscure cases. "What in the first years of the war would have been considered to be due to a non-specific irritation of nerve and muscle, came afterward to be recognized as a local manifestation of tetanus."

Compressive Trauma as an Entity.—As a result of recent additions to our knowledge of injuries and infections of the extremities, faulty alignment and non-union following fractures are certainly less frequent, but the duration of the treatment, particularly the after-care, have not shown advances. Nearly all of the recent advances in traumatic injuries have been toward the improvement of the technic of reduction and the maintenance of the fragments in apposition. Though, as Nathan⁵⁵ says, delayed restoration and permanent loss of function after fractures is the result of faulty alignment and non-union in but a small proportion of the cases.

He considers the morbid conditions which result from trauma to a limb as a whole, not only to the bones. Excluding those cases of concomitant injury to a large bloodvessel or nerve trunk, delayed functional recovery after fractures, irrespective of consolidation, is caused by one, or a combination of several, of the following clinical conditions:

1. More or less marked and persistent neuromuscular or neurotrophic and vasomotor disturbance.
2. Inhibition of joint motion with signs of intra-articular injury and peri-articular and intra-articular inflammation.
3. Inhibition of joint motion with signs of intra- or periarticular injury and inflammation, or those in which intra- or periarticular inflammation appears when reestablishment of joint mobility is attempted.

The signs of injury to an important bloodvessel or a complete interruption of conduction in a nerve are so definite that they need no discussion. However, there are types of injury in which the lesion is not so definite. This is particularly true of the neuritic phenomena which occur in fractures and injuries of the extremities. He classifies them in three groups:

Group I. In fractures of the distal parts of the extremities we frequently meet with cases in which the bones are firmly united and in good position, though swelling, pain and mild neurotrophic disturbances, such as glossy skin, hyperidrosis, etc., persist. There are usually no definite localized disturbances of sensation nor motor abnormalities which can be ascribed to a lesion in a particular nerve trunk (Fig. 3).

Group II. He places in this group cases in which the symptoms of neuromuscular involvement are more marked and persistent. In a few the symptoms can be more definitely ascribed to a lesion or irrita-

⁵⁴ Journal of Hygiene, 1920, **19**, 1.

⁵⁵ Surgery, Gynecology and Obstetrics, January, 1921, No. 1, **32**, 62.

tion of a nerve trunk, thus we have cases of neurotrophic or vasomotor disturbance, glossy skin, hyperidrosis, etc., with pes equinus following fractures and injuries of the lower extremities. In the other extremities we may have, in addition to the vasomotor and trophic abnormalities, characteristic deformities due to lesions or irritation of the various nerves. However, these deformities are not characteristic of an interruption or division of a nerve trunk, but rather of overactivity (extreme spasticity) in the group of muscles supplied by the nerve trunk. Thus, the deformity is paradoxical, simulating more or less the condition found when an antagonistic group of muscles is paralyzed, but, in reality, no paralysis exists in these cases. In some of these cases there are signs of typical neuritis, though the affected nerve is not in proximity to the fracture or involved in the callus. Although these deformities are perfectly characteristic in a certain percentage of cases, the spasticity which produces joint deformity more often involves muscles or groups of muscles not supplied by the same nerve trunk, and the sensory, vasomotor and neurotrophic disturbances are irregularly distributed.



FIG. 3.—Persistent swelling, pigmentation, hyperidrosis, pain and impaired mobility of the wrist and fingers but no deformity, following fracture of the radius and ulna united in good position. (Nathan.)

In Group III, he places the cases usually designated as "ischemic paralysis," von Volkmann's paralysis.

In order to better understand the pathology of these conditions, Nathan has for some years experimented upon animals, and he has found that the injury to the vascular and neuromuscular apparatus of the extremities resulting from trauma are much greater and more extensive than the external appearance of the member would lead one to suspect. Hence, it must be assumed that, in the human subject, compressive injuries, violent or continued long enough to produce fracture, always produce considerable injury to the soft parts, involving not only the immediate vicinity of the traumatized area, but extending a greater distance than heretofore suspected. The pathology explains the clinical phenomena. Neuromuscular, neurotrophic and neurovascular disturbances result from one or two conditions: The vessels are always injured; the neuromuscular structures themselves may be injured or suffer indirectly as the result of the compression due to the extravasation or a secondary inflammatory exudate. The clinical manifestation will vary according to the location of the trauma, its

violence and the severity and extent of the secondary inflammation. The morbid conditions in moderate trauma may involve one or more nerve trunks or their important branches, but, in the majority of cases, only the terminal nerve filaments and the muscle fibers themselves are affected. Consequently, in the mild trauma, we find, clinically, that the manifestations rarely correspond to the injury of a single nerve trunk, but of irregularly distributed sensory, neuromotor and neurotrophic disturbances. In the more decided trauma, the muscle fibers are apt to be lacerated; there is marked compression of the terminal nerve fibers; and large nerve branches or nerve trunks are often included in the hemorrhage and inflammation. In these, the clinical manifestations, of course, are more marked, more extensive and more persistent. The muscular retraction and the resulting joint deformities are a result of a combination of lesions in the muscles, nerve terminals and nerve trunks. As these combinations are endless, the ultimate deformity presents numerous variations.

It must also be appreciated that the resulting deformity is greatly influenced in all these cases by the position of the limb during the activity of the inflammatory process. Dressings may inhibit or exaggerate the tendency to deformity and permit shortening of muscles not actually involved in the morbid process. Thus, a cock-up splint will greatly increase the tendency to the claw hand of ulna paralysis, and a splint which permits the arm to remain pronated frequently leads to the loss of supination, although neither the biceps nor the musculocutaneous are involved in the trauma or in the reactive inflammation. In extremely violent trauma, the muscle tissue is found to be almost completely severed and necrotic for a considerable distance beyond the injured area. Numerous vessels in the neighborhood and at a distance are also torn, and many of the large vessels are thrombotic. Thus, the area is not only directly injured by the trauma but, in addition, loses the greater part of its blood supply. The ultimate result then will be the substitution of scar tissue for the lost muscle fibers which involves not only the muscle tissue but all the subcutaneous tissues down to the bone, so that the skin, muscles, nerves and blood-vessels become bound together in a mass of dense, contracted connective tissue.

Nathan explains the condition known as *Volkmann's ischemic paralysis* as occurring in this way. He claims that there is always a history of direct violence soon followed by severe pain, considerable swelling and inflammation, and the formation of a contracting cicatrix which binds down all subcutaneous tissue. It is not, as has been generally accepted, the result of a constricting dressing but, while not wholly responsible for the condition, they certainly would increase the gravity of the condition by interfering with the blood supply to tissues so seriously disabled. Nathan further found that there was very little change in the morbid anatomy when, as a result of trauma to the tissues, the skin was unbroken, there was an open sterile wound or an open infected wound when the injury was produced by direct violence. His conclusion is that fractures by direct violence must be distinguished from those caused

by indirect violence, not only because of the difference of the character of the resulting break in the bone but also because those resulting from direct violence are accompanied by morbid conditions in the soft parts always as important, and many times more important than the fracture in causing prolonged or permanent disability.

When, therefore, fracture by compression occurs, the maximum force must have been exerted, and all the soft tissues within the compressed area have been injured. On the other hand, in compressive force not sufficient to produce fracture, the more vulnerable soft tissues may be seriously injured. Therefore, in the treatment of injuries of the extremities produced by direct violence, the constant moribund changes in the soft tissues require attention just as much as the fracture. Further, as the pathological changes come on immediately or very soon after the injury, their treatment cannot and must not be delayed until the fracture has united, suppuration has subsided, or the wound has closed. It must be instituted at the beginning and concomitant with the fracture.

The Orthopedic Treatment of Burns.—Harrigan and Boorstein⁵⁶ state that, unfortunately, the leading text-books rarely mention, except in a vague way, definite orthopedic treatment for the prevention of the deformities which are so common after third-degree burns. The general practitioner is not the only guilty one, for burns in many hospitals, even at the present time, receive but scant attention from the chief of the service, and it is rare to see orthopedic appliances used in the early stages, anticipating the ultimate contractures. They mention such procedures as the application of a felt collar in burns about the neck, the keeping of the arm in extreme abduction when the axilla is involved; for the region of the hip the feet are tied in abduction to the foot of the bed and the foot of the bed slightly raised. The Thomas-Jones splints for the knee, ankle, shoulder and elbow all have their indication. The most important suggestion, however, is that the postural treatment should begin at the same time as that of the burn, weeks before there are any evidences of scar tissue and contraction. If, with the development of scar tissue, contractures appear, gradually stretching should be begun even though new epithelial layers are necessarily ruptured. Narcosis is, in their opinion, frequently justifiable in order to stretch the contracture. The pictures which they exhibit, however, not only show unnecessary contractures, but from our experience, an unnecessary amount of scar tissue. We have referred, in our reviews of 1919 and 1920, to the results made possible by treating burns as we now do traumatic wounds, and that the amount of scar tissue which results is in direct proportion to the degree of infection and the length of the period that the wound remains open. We feel sure that the same standards of results will very soon be required of surgeons in the treatment of burns, as the public now demands from other forms of traumatic wounds and, if the infection is minimized and the usual contractures anticipated, our results will be wonderfully improved.

Gravimetric Method of Determining the Superficial Area of Wounds.—The employment by Carrel (1910–1916) and du Nouy (1916) of accurate

⁵⁶ Annals of Surgery, November, 1920, No. 5, 72, 16.

methods in estimating the rate of the healing of wounds puts their work upon such a basis that their results are not only above criticism, but also make it impossible to compare them with the results of others not employing such standards.

Carrel has recorded a geometric curve of the cicitization of wounds, and du Nouy has given an algebraic expression to this curve. There is no question that if such quantitative studies could be universally employed in general and hospital practice, a sufficient amount of data would soon be accumulated to eliminate the present element of speculation in determining the action of antiseptics, estimating their comparative values and deciding upon the best methods of employing them. Much light would be thrown on such problems as the rate of healing, the influence of contraction on the healing process, and the value of different methods of skin grafting. That the methods used by Carrel and du Nouy are not simple and practical for general use, time has certainly demonstrated. The exact care necessary in making the free-hand drawing of the tracing of the wound; the use of the planimeter, an instrument of precision requiring attention to maintain its accuracy and costing over fifty dollars, and the inability of the planimeter to measure an area of more than ten square inches are probably factors which have discouraged others in making this method a uniform procedure. An inexpensive and simple technic is essential to the general adoption of any method, and Douglas⁵⁷ seems to offer this in his suggestion of a gravimetric instead of a planimetric method of computing the superficial area of wounds.

The gravimetric method suggested by Douglas consists of the following simple steps. The usual tracing of the exact pattern of the wound is taken by covering it with a transparent flexible sheet. Rubber protective he found the most satisfactory substance. This pattern is then transferred by means of a tracing paper to a sheet of ordinary, accurately cut, bond paper. The cut-out pattern is weighed on an ordinary chemical balance. With the area of the whole sheet, its weight and the weight of the cut-out pattern known, then by simple proportion: Weight of the whole sheet is to the weight of the pattern of the wound as the area of the whole sheet is to the area of the wound. This may be expressed in the following formula: WS:WCO::Area S:Area CO.

where WS = the weight of the whole sheet.

WCO = the weight of the cutout.

Area S = area of the whole sheet, which is known.

Area CO = the area of the cutout or the area of the wound to be determined.

It was found that the close proportion of weight to area in sheets cut with accuracy makes it possible to simplify this calculation by using a
weight
constant ————— or weight per square centimeter.

area

weight

The determination of the constant of ————— is simple if a number of
area

⁵⁷ Annals of Surgery, June, 1921, 73, 673.

sheets are weighed together and divided by the number weighed. This forms the numerator of the constant, while the average of the size of



FIG. 4.—Method of taking a pattern of a wound surface by means of a direct cut-out from semi-transparent rubber tissue. (Douglas.)

four or more accurately cut sheets forms the denominator. Once this is done, enough paper is calibrated for more than an average year's work.



FIG. 5.—Planimeter placed upon an outline the areas of which are being estimated by its use. (Douglas.)

He found the average constant in the papers he used to be 0.005834 gm. per square centimeter of the surface of the paper.

In addition to the simplicity of the method, Douglas speaks of the following advantages:

1. It requires only apparatus which is ordinarily found in hospitals and laboratories, and requires but ordinary skill and care to obtain accurate results.
2. The maximum errors of the gravimetric method are so small that they are, for practical purposes, negligible (0.1 of 1 per cent). They are less than the intrinsic error due to either the tracing of the wound surface on rubber tissue, or to the retracing of this pattern on the bond paper. In practice, it is as accurate as the planimetric method.



FIG. 6.—The weighing of a wound pattern by the gravimetric method. The standard bond sheet from which it was cut is shown at one side. (Douglas.)

Treatment of Suppurating Wounds following Abdominal Section.—We have referred elsewhere in this review to the statement of Sistrunk that in the Mayo Clinic 10 per cent of their clean operative wounds developed infection. This at least shows the importance of this complication, and raises the question as to its proper treatment. The former routine procedure, which consisted in removing all the sutures and opening wide the wound upon the first sign of infection, has been abandoned by us for some years. Watkins's⁵⁸ treatment is as follows: No sutures are removed until the wound is healed unless it becomes necessary on account of extensive cutting of the sutures into the tissues; no drainage is inserted; no probing is permitted. Moist dressings are kept continuously over the wound as long as it remains reddened or indurated. Care should be exercised, however, not to extensively macerate the parts with moist dressings. The value of moist dressing consists almost entirely in preventing desiccation of the secretions and thus favoring drainage. Watkins also still maintains that no antiseptic should be used because of experiments made a long time ago which

⁵⁸ Surgery, Gynecology and Obstetrics, January, 1921, No. 1, 32, 87.

proved that the use of antiseptics did more damage to the tissues than injury to the bacteria, and that wounds treated without antiseptics recovered more rapidly than when treated with them.

We are glad that he makes the exception to the use of chlorinated solutions in wounds which contain necrotic tissue, for recent experiments have clearly proved that the chlorine antiseptics cannot be condemned in such a sweeping statement. We entirely agree with Watkins's practice of not removing the sutures. We have not, however, found that moist dressings alone provided adequate drainage, and that providing a prompt and adequate outlet for the escape of the pus, such as Royster⁵⁹ describes, minimizes the local suppuration and shortens the period of healing. It has been our practice to take out one stitch, the most dependent, allowing the pus to escape and gently irrigating the cavity of the wound daily with one of the chlorine group of antiseptics. Drainage is never inserted under any circumstances. For the last year we have been following Royster's method of making an incision through the healthy skin to one side of the operative incision but we have not injected such a foreign body as melted iodoform ointment into healing tissues, and cannot see the least justification for such a procedure.

The Passing of the Septic Hand.—An editorial in the *Boston Medical and Surgical Journal*, November 25, 1920, calls attention to Kanavel's monograph, as the first intensive study of the infections of the hand. Before this era almost anybody was considered competent to treat and operate upon a bad septic hand, though a simple operation for acute appendicitis was considered a major procedure; the fact being that a careful, well-planned operation upon the hand requires infinitely more skill and judgment.

They comment that during the last few years the patient with a serious septic hand is rarely seen in the surgical outpatient clinics of the city hospitals. There are two reasons for this: (1) The general public is, perhaps, better educated to the importance of the attention to infections of the fingers and to minor cuts and scratches; (2) the improvement in the operative procedures for the relief of the less septic conditions.

THE AFTER-TREATMENT OF INFECTIONS OF THE HAND.—The most valuable asset of the working man is his hand, and the infections of the hand require of the surgeon not only the control of the infection, but that he see that proper and adequate after-treatment is carried out. Kanavel⁶⁰ has made a classical contribution upon the operative treatment. Clinically, there are two common types of hand infection, those due to streptococcus, and those due to the staphylococcus and similar organisms. In both types it is essential that active and passive motion should be begun as soon as possible after drainage has been instituted. In a case of staphylococcus infection, the patient should be urged to use his fingers for ten or fifteen minutes three or four times a day, performing all possible motions by the end of thirty-six hours. If the infection

⁵⁹ Surgery, Gynecology and Obstetrics, January, 1921, No. 1, **32**, 90, 91.

⁶⁰ Surg. Clin. of Chicago, 1920, **4**, 1165.

is due to streptococcus, a delay of twenty-four hours may be advisable. If the patient's temperature should rise after these manipulations, passive and active motion should again be delayed for another twenty-four hours, when they can be cautiously recommenced. Forty-eight hours after the operation an arm bath, large enough to permit complete immersion of the hand and forearm, may be substituted for the hot, wet dressing. The entire hand and forearm should be kept in the bath for twenty minutes two or three times a day, when the fingers and the muscles of the forearm should be actively moved. Of course, the water should be as warm as can be borne. At the end of four or six days the infected hand should be exposed to the rays of an electric light immediately after the bath until the skin is thoroughly dried. If the incision has been so made that the tendons prolapse, a dorsal splint should be worn during the time that the hand is not being exercised. Kanavel believes that the common deformity of flexion at the wrist-joint following infections of the hand results from the wearing of bandages and dressings for a long period of time and no attention being paid to the proper after-treatment. Within ten days or two weeks other devices will have to be found in order to interest the patient, such as typewriting and piano-playing. For exercising the fingers and wrists, Indian clubs, handball, golf and tennis are helpful. When there are abscesses in the hand which do not involve the tendons, complete restoration should be secured within a month. Involvement of the tendon sheaths requires a longer period, 85 per cent of function should be secured within four months, 95 per cent within six months, and 100 per cent within a year.

Soaps in Relation to Their Use for Washing Hands.—Norton,⁶¹ in a series of experiments, attempted to determine the following practical points in the use of soaps for the cleansing of the hands.

1. The relative efficiency of various soaps in removing bacteria from the hands. He found that the hands were not rendered sterile in the ordinary process in washing. More bacteria were removed by the ordinary toilet soaps than any of the special so-called antiseptic and germicidal soaps. In other words, the cleansing property of a soap is more important than its germicidal or antiseptic constituents.

2. The relative germicidal power of the soap solutions obtained in washing the hands. He found that these solutions had practically no germicidal or antiseptic value.

3. In the whole process of hand-washing done in the usual manner, the special so-called germicidal or antiseptic soaps exhibit none of the special properties ascribed to them.

Picric Acid in Operative Surgery.—G. E. Farr,⁶² experimenting on animals, found that the intraperitoneal injection of watery solutions, ranging from 1 to 2 c.c. of a 1 per cent solution, and 0.05 to 1 c.c. of 5 per cent solution produced no immediate effects, and after the expiration of six weeks no adhesions or abnormalities in the abdominal organs were found upon opening the abdomen. These laparotomies

⁶¹ Journal of the American Medical Association, 1920, **75**, 302.

⁶² Annals of Surgery, 1921, vol. **73**.

were performed under anesthesia, the preparation consisting in the application of 5 per cent alcoholic picric acid solution to the skin. The operator's hands were prepared by immersing them in the same solution, and the intestines were handled roughly by the operator and allowed to come in contact with the picric acid on the skin. Postmortem examinations made later could discover no adhesions, and the conclusions seemed justified that, at least in guinea-pigs, picric acid in rather large amounts does not tend to produce intestinal adhesions. It is Farr's opinion that the chief value of picric acid lies, not in its germicidal power, but in its tanning qualities. He believes that the bacteria are mechanically held in the thick pellicle of tanned skin which develops after the use of the acid, and this holds them enmeshed until the wound is sealed. The condition of the wound edges at the end of an operation is quite different from that seen after the use of iodine. Iodine practically disappears and is distributed in the wound, on the towels, sponges, etc., but practically all the picric acid remains, however protracted the operation. Farr considers it an ideal germicide for the preparation of the skin for operation, because it never irritates and it remains on the skin for a long period of time.

Mercurochrome as a General Germicide.—Young⁶³ publishes reports from various workers of the use of this antiseptic agent, they practically all refer to its application to mucous membranes. Its use in other tissues has not been very extensive, and the title of the paper is misleading. His conclusions are as follows:

1. Mercurochrome has proved to be a very valuable drug in acute gonorrhea, but the resulting intense stain is a drawback to its use as an injection by the patient. Acriflavine is free from this objection and, though not so good a germicide, it is often preferable in acute cases.
2. In chronic infections of the urethra, prostate and vesicles, the great value of mercurochrome has been amply proved. It penetrates deeply and may be found in the prostatic secretion several days after posterior instillation.
3. The results obtained in many cases of chronic cystitis are remarkable, long-standing infections often clearing-up in a few treatments. In some cases which failed to become sterile constant reinfection of the bladder is found to occur from kidneys or prostate.
4. Mercurochrome is less irritating and produces less reaction in the renal pelvis than silver nitrate solutions, while possessing about equal germicidal powers; but in some cases both drugs should be used alternately, and sometimes silver is better.
5. In some cases of pyelitis, the infection comes from the teeth, tonsils, etc., and sterilization of the pelvis is impossible until the primary focus is cured.
6. Continued use has proved it to be a most satisfactory dressing for venereal ulcerations and buboes.
7. In general surgery, reports indicate that mercurochrome is a very valuable dressing in open wounds and sinuses.

⁶³ Journal of the American Medical Association, July 9, 1921, No. 2, 77, 93.

8. The germicidal efficiency of the drug in other branches of medicine and surgery has been proved, especially in the treatment of infections of the throat, nose, sinuses, ear, eye and teeth. It is reported to be most efficient in disinfecting the throats of diphtheria carriers.

It is to be hoped that carefully controlled work with other tissues, similar to the standard established by the Rockefeller Institute in their work with the chlorine antiseptics, will be undertaken. While the voluminous clinical reports which they present are interesting, they are not unusual, and before its real value can be established in the general surgical infections it will have to experience tests similar to those given to other agents by Dakin, Carrel, Dehelly and their co-workers.

Heliotherapy.—Hill⁶⁴ gives an interesting and new explanation of the superior therapeutic value of the rays of the sun over those of artificial light. Sonne, of the Finsen Light Institute, has found that three times as much sunlight is required to burn the skin as that derived from what he calls dark heat. He explains the difference as being due to the fact that the visible rays of the sun penetrate the skin and are absorbed by the blood circulating in the deep and subcutaneous tissues, while the dark heat is mostly absorbed by the surface of the skin and produces the reaction there. Sonne has also found that sunlight will increase the temperature of the blood beneath the skin 5° more than will dark heat, when the surface of the skin in both cases is heated to just an enduring degree. The visible rays absorbed by the blood are converted into heat, and the heat, carried away by the circulating blood, raises the general temperature of the body. When the whole body is exposed to the cooling breezes of open air, the general temperature will remain constant, while locally the blood and deeper portions of the skin exposed to the direct rays of the sun may have their temperatures raised to a height exceeding that of a high fever. Hill believes that this local heat has a profound effect on the immunity of the body to disease. Children with tuberculosis of the bones, joints, glands and skin respond well to heliotherapy in the open air. He further believes that it is the visible, not the ultraviolet rays that stimulate health, for the latter are absorbed by the surface layer of the skin and have the least penetrating power. To protect against overdoses of the visible rays, the skin becomes pigmented, and clinical experience has shown that it is those who pigment deeply who make the best progress. The red-haired, fair-skinned children who do not pigment apparently do not secure the full benefits of exposure to the sun. The dark heat (non-luminous) that is secured from stoves, steam pipes and hot water is a sorry substitute for sunshine.

TREATMENT OF SURGICAL TUBERCULOSIS BY HELIOTHERAPY.—Of 191 cases of surgical tuberculosis, Harrass⁶⁵ reports a mortality of only 4.2 per cent. He declared that results such as he reports calls for application of heliotherapy on a large scale, but emphasizes that provisions must be made for a course of treatment over a period of time long enough to accomplish the purpose. From five to thirty-five months

⁶⁴ London Times, referred to Journal of the American Medical Association, July 9, No. 2, 77, 135.

⁶⁵ Deutsche Zeit. f. Chir., Leipzig, June, 1921, 2, 163.

were required for this group of cases. In 16 cases of tuberculosis of the ankle-joint, 56.2 per cent were cured. In 23 cases of the knee-joint, 56.5 per cent were cured. Four shoulder cases, 100 per cent were cured. In 36 cases of vertebral caries, 80.5 per cent were cured.

Pericardiotomy for Suppurative Pericarditis.—Suppurative pericarditis is not a rare lesion, though up to the present time operations for its relief are relatively infrequent. Stone⁶⁶ found purulent pericarditis in 14.5 of 300 patients who had died of pneumonia. None of the 44 cases had been operated upon. These figures, however, are much higher

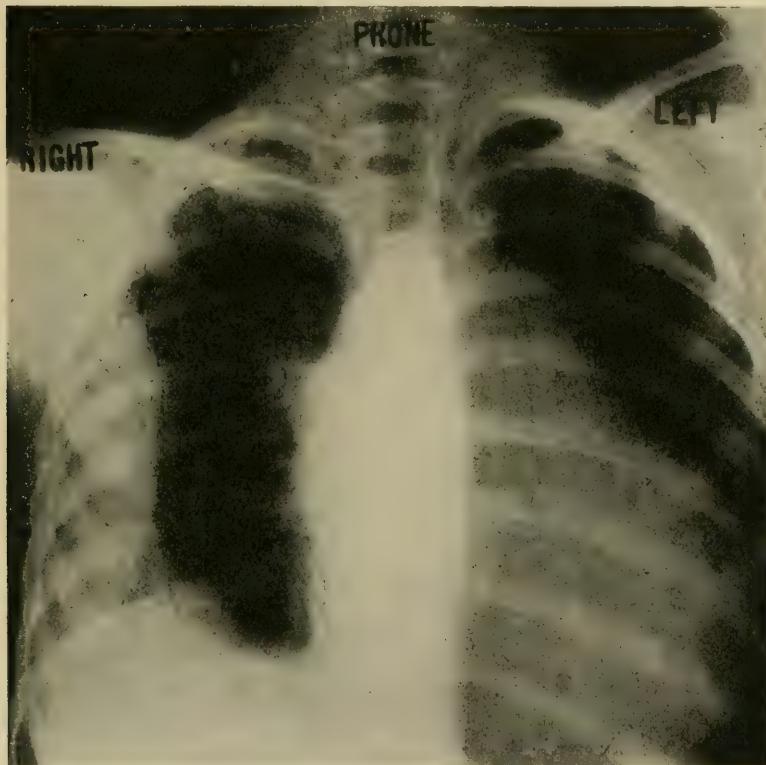


FIG. 7.—On admission. (Pool.)

than those of most observers, and the variance in the statistics is due to the fact that the incidence of this complication of pneumonia varies greatly in different epidemics and in different years; though Stone says that the diagnosis of pericardial effusions should offer no difficulty when the amount reaches 300 to 500 cm. Osler states that perhaps no serious disease is so frequently overlooked by the practitioner.

Because the involvement of the pericardium is usually secondary in a condition of general sepsis, and often constitutes a terminal infection, medical men rarely refer these cases to the surgeon. Consequently,

⁶⁶ Journal of the American Medical Association, 1919, **73**, 254.

operations in general have not been sufficiently early nor often. The prognosis, though extremely grave in secondary infection of the pericardium, is not necessarily hopeless, as has been less repeatedly demonstrated by the recovery of apparently moribund patients. Pool⁶⁷ reports a case of a boy, aged nine years, in which pericarditis developed on the nineteenth day of a left lobar pneumonia. The *x*-ray on admission (Fig. 7) shows the enlarged heart shadow, also an empyema of the right pleural cavity. Fig. 8 shows the result after six months. Bacteriological examination showed a pure culture of pneumococcus Group IV,

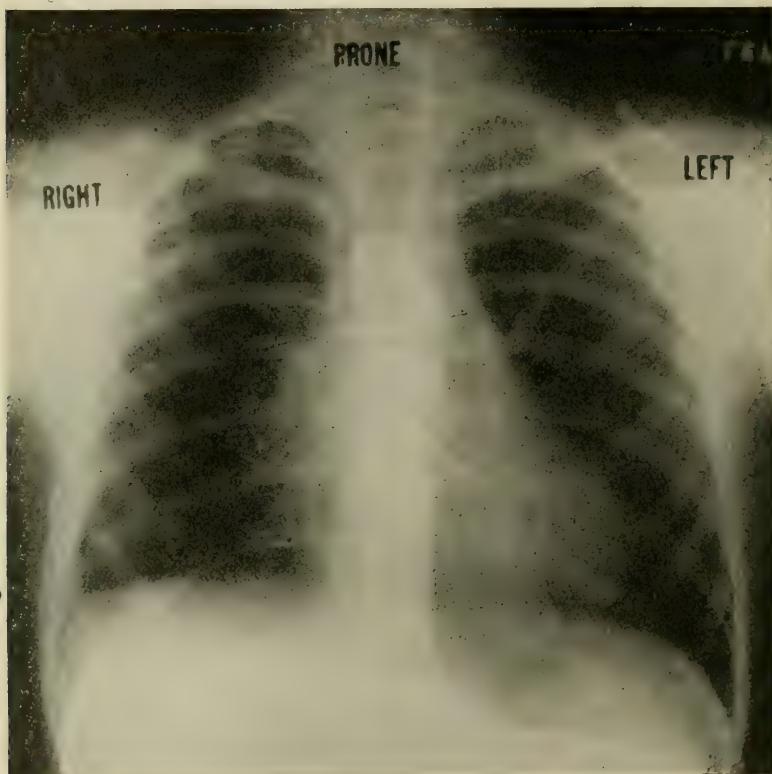


FIG. 8.—Six months after operation. (Pool.)

obtained from the pericardial pus and also from the pleural cavity. Ten days after the operation cultures from the pericardium and right pleura showed pure cultures of *Streptococcus hemolyticus*.

The technic of the operation which Pool successfully employed he describes in detail. It is a modification of the method presented by Delorme and Mignon. The incision (Fig. 9) begins at the middle of sternum at the level of the lower margin of the fourth costal cartilage; it curves downward and passes to the left until it reaches the upper margin of the chondrosternal junction of the fifth cartilage, then down-

⁶⁷ Annals of Surgery, April, 1921, No. 4, 73, 27.

ward close to the left edge of the sternum, crossing the fifth and sixth cartilages and at the middle of the seventh cartilage it curves outward following along its anterior surface. The soft parts are freed and retracted, the resultant wound being an ellipse. The seventh costal cartilage is divided at the sternum. The soft parts are detached along its borders and the cartilage is lifted from the tissues. It is easily freed from the perichondrium posteriorly. A complete subchondral section is not attempted because the perichondrium anteriorly and at the borders is firmly adherent and separated with difficulty. The

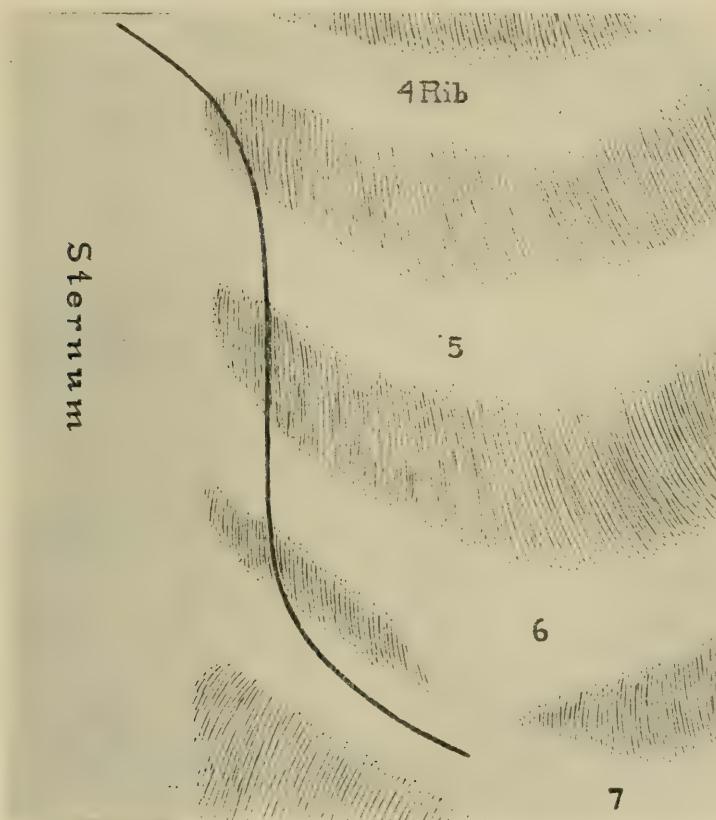


FIG. 9.—Incision for pericardiotomy. (Pool.)

cartilage is fractured about two inches from its sternal end and removed. The same procedure is carried out with the sixth and fifth cartilages. (Fig. 10). The thin layer, including internal intercostal muscles, and posterior perichondrium, is incised vertically and separated from the underlying tissues. This exposes the internal mammary vessels. They lie at the upper part of the wound about one-half inch from the sternum, and should be ligated above and below to lessen the danger of secondary hemorrhage. The thin triangularis sterni is separated from the sternum and, with finger or blunt instrument, the underlying

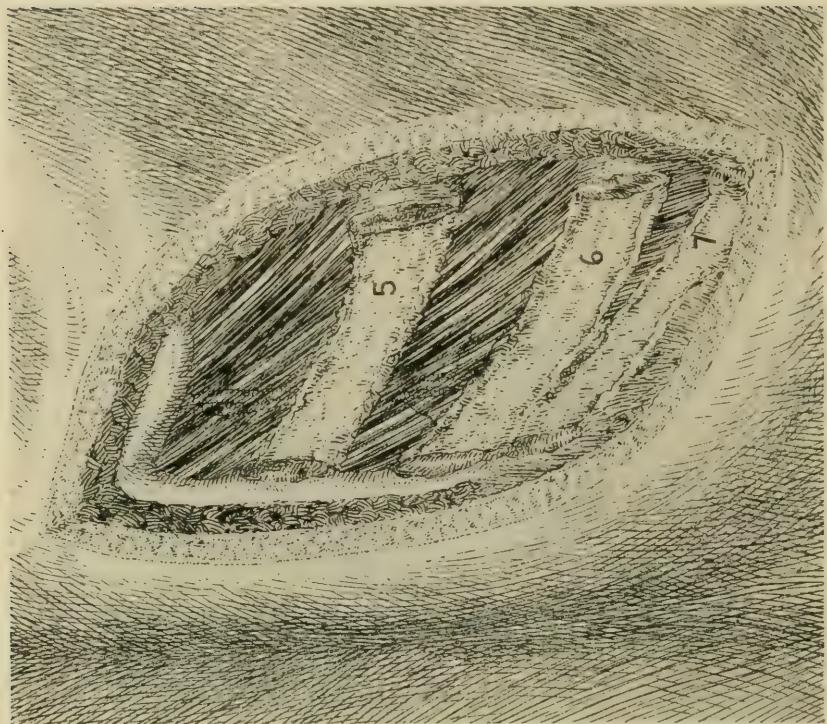


FIG. 11.—Cartilages resected, leaving posterior perichondrium and internal intercostal muscles. (Pool.)

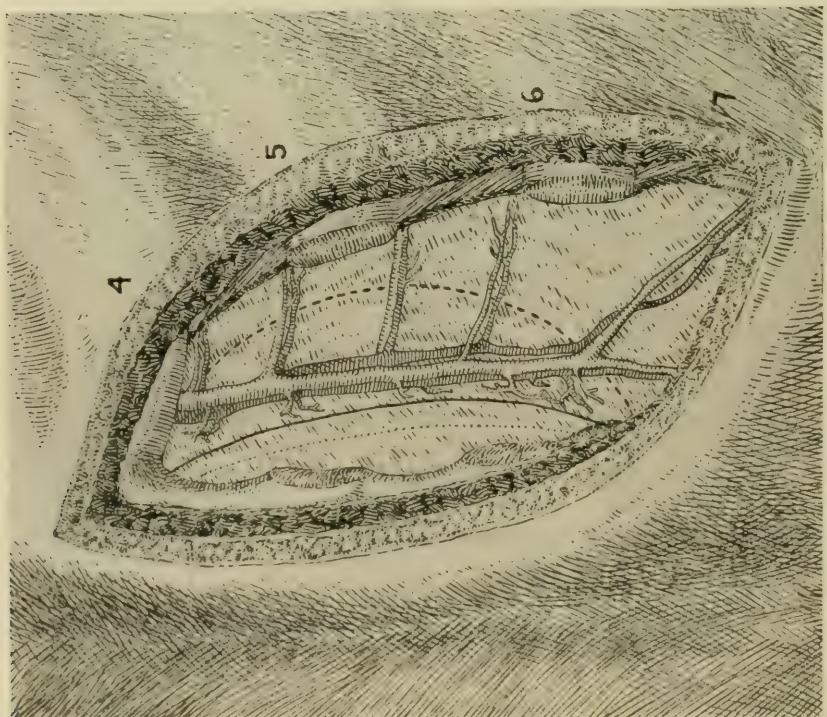


FIG. 10.—Diagrammatic: Portions of fifth, sixth and seventh cartilages removed. Approximate relations of lung, pleura and internal mammary vessels to line of incision in pericardium. —— line of incision in pericardium. - - - line of pericardial incision. (Pool.)

fat, and with it the edge of the pleura, are displaced outward. The pericardium is thus exposed and is opened between forceps, about 1 cm. from the edge of the sternum (Figs 11 and 12). The incision should extend downward to the reflection of the pericardium to the diaphragm. It should be slightly curved with a concavity toward the sternum, if possible the edges of the pericardium should be sutured to the skin or superficial as soft parts to diminish the danger of mediastinitis. Though a formidable operation, Pool does not consider it too grave to perform

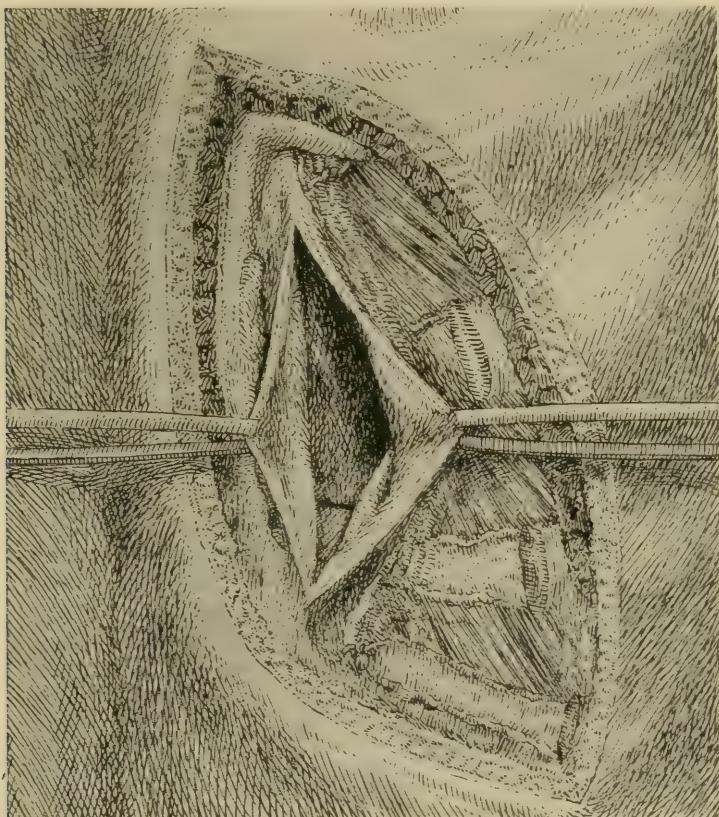


FIG. 12.—Pericardium opened, showing heart and diaphragm. (Pool.)

under general anesthesia. Though in his case he did not insert his Carrel tubes and Dakin's solution until after thirty-six hours, because there were no previously reported cases of this kind, in the future he will start the Carrel-Dakin method at the time of the operation. The tendency of the pus to become thick and wall off the cavity into chambers, resulting in retention of excretion and imperfect drainage, is a clear indication for the solvent action of Dakin's solution and practice in this case confirms the theory. The solution apparently exerted no noxious influences upon the pericardium. The method suggested opens

the pericardium at its lower part, involves little risk of injury to the pleura, provides ample drainage and allows such exploration as is necessary, both at the time of the operation and during the postoperative course.

Purulent Pericarditis.—Whittemore⁶⁸ reports a case of purulent pericarditis operated upon by using the trocar and cannula method, which has been described with many variations in the treatment of empyema. After entering the pericardium with the trocar and cannula, a No 10 French catheter closed with a hemostat was quickly slipped through with the cannula into the pericardial cavity from eight to nine inches from the skin. The catheter was so tightly in place suction was then done every two hours for the first twenty-four hours until the amount obtained was less than 3 cc, then the time was lengthened to four hours, and, finally, to twice in twenty-four hours. When the amount in twenty-four hours was only 1 to 2 cc, the catheter was removed. Twelve hundred cubic centimeters of pus were removed during the first twenty-four hours, and the sinus was entirely closed at the end of eight weeks.

Removal of a Missile from the Right Ventricle of the Heart.—Luckett⁶⁹ reports a case in which, by means of oxygen injection of the abdomen, an x-ray picture showed a missile in the heart. This was verified by the fluoroscope with which the foreign body could be seen moving with the pulsating heart. A five-inch incision was made in the sixth intercostal space. Thoracotomy was done and the wound held open by a Tuffier rib spreader. The missile was palpated in the right side of the heart near the apex. There was no blood in the pleural cavity and, upon opening the pericardium, it was also free of blood. The heart was delivered through the pericardial incision and rotated forward from right to left and upward. An incision was made through the heart muscle overlying the missile which was then extracted; this was followed by a free gush of blood, controlled by catgut sutures. The pleural cavity was drained and empyema developed, but the patient made a complete recovery.

Cardiac Massage.—During the last few years references to the value of cardiac massage in accidents complicating the administration of anesthetics for surgical purposes have been increasing. The term has been applied to widely divergent methods, thus many cases are recorded of accurate and vigorous massage of the precordium without any direct contact with the heart. Any effect attained in this way is probably reflex rather than direct. Others have massaged the heart, during abdominal operation, by using pressure through the diaphragm, and still others have been so radical as to incise the diaphragm, enter the hand through the incision and perform actual massage of the heart by pressure with the fingers. Hare,⁷⁰ in an editorial, refers to research work of his in 1893 upon chloroform, when he frequently found that after the heart's action had stopped and the blood-pressure had fallen to zero, if artificial respiration was established and the chest opened, massage of the distended cavities of the heart, the walls of which were

⁶⁸ Surgery, Gynecology and Obstetrics, April, 1921, No. 4, **32**, 371.

⁶⁹ Ibid., October, 1920.

⁷⁰ Therapeutic Gazette, January 15, 1921, No. 1, **37**, 21, **45**, 3 series.

fibrillating, would result in the emptying of these cavities and the reestablishment of pulsation. Levy, in *Heart*, vol. 7, No. 3, quotes experiments of Prus upon dogs, and concludes that it is his belief that artificial respiration is absolutely essential when cardiac massage is practised. He thinks that Sylvester's method is sufficient when there is no opening in the pleural cavity, provided it does not interfere with the proper performance of massage, but he recommends intubation of the larynx, the attachment of a tube and insufflation of the patient by positive pressure supplied by a machine or by the blowing of another person. If no artificial respiration apparatus is at hand, he even suggests mouth-to-mouth insufflation. Artificial respiration is not only advantageous because of its influence upon the circulatory system, but also because it serves to eliminate the anesthetic from the tissues. He further believes that the value of massage of the heart consists more in the production of an artificial circulation of oxygenated blood through the coronary arteries than upon the direct irritation of the heart muscle by handling, and points out that the successful performance of massage depends upon the efficient compression of both ventricles. Levy also insists that, in order to prevent death, cardiac massage should be instituted not later than five minutes from the onset of cardiac failure, and that two minutes is probably the outside limit for the chance of spontaneous recovery in man, after which the necessary operative procedures for adequate cardiac massage should be undertaken.

A Successful End-to-end Suture of the Common Carotid Artery in Man.—Sloan⁷¹ reports a successful case of suture of the common carotid, which from literature appears to be one of the rarest of operations, but 8 other cases being on record. In only 1 of them, that of Denk, is there reported the presence and continuance of pulsation in the temporal artery on the side of the resection. Experiments have shown that the recovery rate after the ligation of the common carotid is 33 per cent. It follows, therefore, that survival does not necessarily prove that the carotid is patent after circular suture unless the temporal pulse is demonstrated. In the case reported by Sloan, which was a second operation for a recurrent carcinoma of the lower lip and neck, the common carotid was nicked as it lay in a mass of scar tissue. The vessel was further traumatized with the hemostats, and before the bleeding was controlled the vessel wall was badly damaged for about 0.75 cm. Appreciating the danger to life at the age of fifty-six if the common carotid is ligated, they planned a repair of the vessel. A lateral repair of the wall would have cut down the blood supply probably two-thirds, and experiment has shown that a thrombus will more probably be formed distal to a lateral suture than to a circular one because of the greater opportunity for stasis in the peripheral back eddy of the blood stream just after it passes a constricted point in the lumen of the vessel. Therefore, the damaged area of the vessel was excised and an end-to-end anastomosis performed.

⁷¹ *Surgery, Gynecology and Obstetrics*, July, 1921, p. 62.

After making an ample exposure of the artery, the vessel was clamped off proximally and distally to the rent with carotid clamps, which had their jaws protected with rubber tubing (Fig. 13). The damaged area of the vessel, 8 mm. in length, was excised; and the loose tissues cleaned off from the cut ends. In order to approximate the divided artery without tension, the patient's head was raised on a small pillow and then rotated on its longitudinal axis, 15 degrees away from the side on which they operated. Thus the patient's face was turned toward his left and at the same time approximated toward the right shoulder. Carrel's original method, employing three guy sutures, was used. Straight No. 16 needle and triple 000 linen split twelve times. Needles and sutures were well lubricated with vaseline. On account of the proximity to the clavicle and the shortening of the bloodvessel, the most difficult part of the suture was on the posterior aspect of the vessel between the first and the third guy sutures. Moreover, the

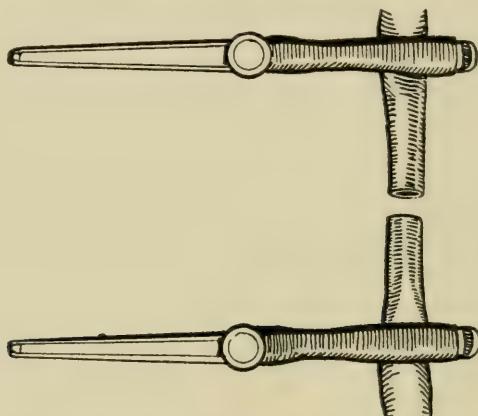


FIG. 13.—Ends of the artery have been striped of adventitious tissue and are ready for the placing of gut sutures. (Sloan.)

vessel wall was quite sclerosed and had very little elasticity. It was possible to peel off a ring from the cut end as one would uncurl the end of a coil spring. In removal of the distal carotid clamp when the suture line was finished, two places were found from which fine streams of blood spurted. A single stitch at each of these points made an absolutely tight suture line. The suture line was further protected by pulling the deep fascia over it and stitching it in place. After the repair of the carotid artery, the dissection of the neck was completed. The gland-bearing area of the superior triangle was excised *en bloc*, and the skin closed with clips. During the operation the circulation was cut off from the right side of the brain for thirty minutes; but on completion of the operation pulsation was felt in the temporal vessel on the side of the sutured artery. On the third day the pulsation on the two sides was equal and has continued so ever since. The patient made an uninterrupted convalescence and is still living.



FIG. 14.—Truesdale's modification of Sehrt's tourniquet. (Meyer.)

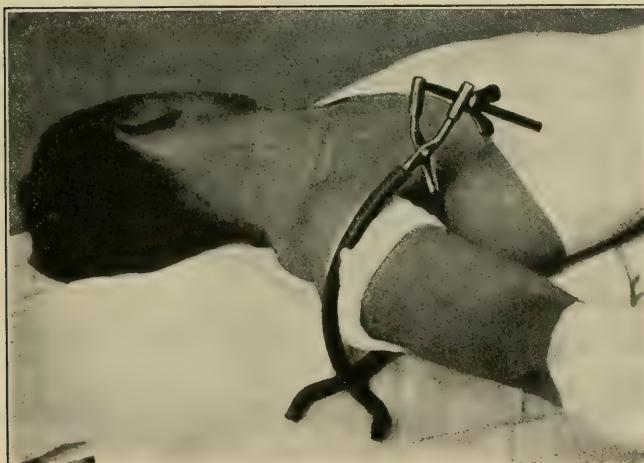


FIG. 15.—Compressing the vessel of the arm. (Meyer.)

Aneurysm of the External Carotid Treated by Ligature of the Common Carotid Artery and Internal Jugular Vein.—Peverley and Haworth⁷² report a large tumor of the neck due to an aneurysm of the external carotid artery. The common carotid artery and internal jugular vein were tied simultaneously at the seat of election. The pulsation disappeared at once and the after-course was uneventful.

Sehrt's Metal Tourniquet for Producing Artificial Anemia.—This metal tourniquet has been referred to from various sources during the war, and one of the instruments was obtained by Truesdale from a captured German hospital at Saint-Mihiel. Truesdale's⁷³ description says "It is simple to adjust, safe in its effect on the tissues, definite in its control of bleeding and very adaptable for the purpose in operations on the upper and lower extremities." Meyer⁷⁴ believes it to be the greatest advance made within recent years as regards effectiveness and ease of producing artificial anemia (Figs. 14 and 15).

Saphenous Varix.—The uncommon dilatation of the terminal portion of the saphenous vein near its entrance into the femoral is frequently mistaken for a femoral hernia. This dilatation is sometimes found to be of considerable size, and, when the patient is standing, may easily be seen as a protruding mass in approximately the location of a hernia through the femoral canal. It is often painful and symptomatically readily suggests a femoral hernia.

De Quervain⁷⁵ gives the following differential diagnosis: (1) In the case of saphenous varix a bluish sheen is seen in the skin overlying the swelling; (2) the tumor is easily compressible and promptly reappears upon the removal of the pressure; (3) it fluctuates in size with every change in venous pressure, as coughing, vomiting, erect or prone position and normal breathing. However, the bluish tinge is absent if the subcutaneous fat is pronounced; also, as in a recent case we have seen, it is difficult to detect in a negro. The compressibility is frequently as marked in a hernia. The increase and decrease in size is not unlike the change of size of a hernia upon coughing and vomiting and its disappearance, when in the recumbent position, quite similar to the spontaneous reduction of a rupture.

Stetten⁷⁶ reports a case which had been operated upon some months previously by a careful plastic Lotheisen method, though the sack had not been found at the time of the operation. A recurrence was noted almost as soon as the patient got out of bed. Reoperation for the hernia had been advised and was about to be carried out when he saw the patient in consultation. He makes the following additions to the differentiation of the two conditions.

The condition of the swelling in the dilatation of the saphenous is usually somewhat lower than in the case of a femoral hernia. While this dilatation may be at the saphenous opening, just at the entrance of the

⁷² British Medical Journal, March 5, 1921.

⁷³ Journal of the American Medical Association, January 31, 1920.

⁷⁴ Annals of Surgery, December, 1920, No. 6, 72, 763.

⁷⁵ Spezielle chirurgische Diagnostik fuer Studierende und Aerzte, Leipzig, 1907, p. 301.

⁷⁶ Surgery, Gynecology and Obstetrics, March, 1921, No. 3, 32, 235.

internal saphenous into the femoral vein, it is generally 1 or 2 cm. below the junction. In the case reported, there was an interval of nearly 2 cm. between the sacculation and the opening into the femoral. As a rule, other varicose veins will be found on the leg and thigh if a dilatation exists near the saphenous opening. When the patient stands, the internal saphenous vein itself is generally very evident as a distended vessel, running between the inner posterior aspect of the knee and the aneurysmal sack. Reduction of the tumor and pressure over the femoral ring by the examining finger does not hold back a saphenous varix if the patient strains or stands: Finally, the impulse on coughing differs materially in the two conditions. Instead of a frank impulse, as in a hernia, there is, in the venous dilatation a fluid wave or thrill. This is readily elicited if only light pressure is made during the examination. This last sign is almost pathognomonic. It can be simulated in hernia only when there is a coëxistent ascites.

Suturing of Bloodvessels.—Horsley,⁷⁷ in reporting a suture of the brachial artery, enumerates the indications for bloodvessel suture. In its early development the suturing of bloodvessels was a very spectacular branch of surgery, and it seemed to give hope of many things. Time, however, has shown that in the transplantation of organs and extremities, even though the technical result of suturing the bloodvessel was perfect, atrophy of the transplanted tissues always occurred because of the fine biological differences between the host and the donor. Transfusion of blood was originally practised by suturing the vessels. The citrate method, however, has practically supplanted this method so that the field for bloodvessel suture has greatly contracted. Collateral circulation develops much less readily in adults after the age of thirty-five than in the young. An arterial lesion that can be satisfactorily treated by simple ligation in a youth of twenty, may result disastrously if preformed in a patient of forty. There are also certain locations in which injuries to a large artery are likely to be followed by gangrene. Ligation of the popliteal artery, for instance, will more probably cause gangrene than tying the femoral higher up. This was demonstrated over and over again in the surgical experiences of the recent war. The same condition appears to be true about the lower part of the brachial artery. We have previously referred to this in our review in PROGRESSIVE MEDICINE, December, 1919. Horsley, in the case reported, employed the method of bloodvessel suture which he described in 1915.⁷⁸ and Fig. 16 explains the method very satisfactorily. This case was a complete division of the brachial artery and a partial division of the median nerve just in front of the right elbow. The wound was transverse and just in front of the elbow-joint. An incision at right angles to the wound thoroughly exposed the divided brachial artery, which was found to be one and a half inches above the origin of the ulnar and radial arteries. The brachial vein was also severed. The fact that the patient was thirty-seven years of age indicated to Horsley that suture of the artery was indicated instead of ligation.

⁷⁷ Journal of the American Medical Association, July 9, 1921, No. 2, 77, 117.

⁷⁸ Surgery of the Bloodvessels, St. Louis, C. V. Mosby Co., 1915, pp. 46 to 77.

The ends of the severed vein were tied and, after trimming away the injured portions of the divided ends of the artery, they were sutured with a double mattress stitch of 00000 silk. When the patient was examined a year after operation, pressure over the artery at the site of the suturing completely obliterated the radial pulse, which returned again when the pressure was removed. Horsley properly states that ligation of the lower brachial artery in a patient, aged thirty-seven years, with an injury of such a character that some of the anastomotic vessels were probably affected, would doubtless have been followed by either gangrene or ischemic pains on exertion with consequent impairment of function of the right forearm.

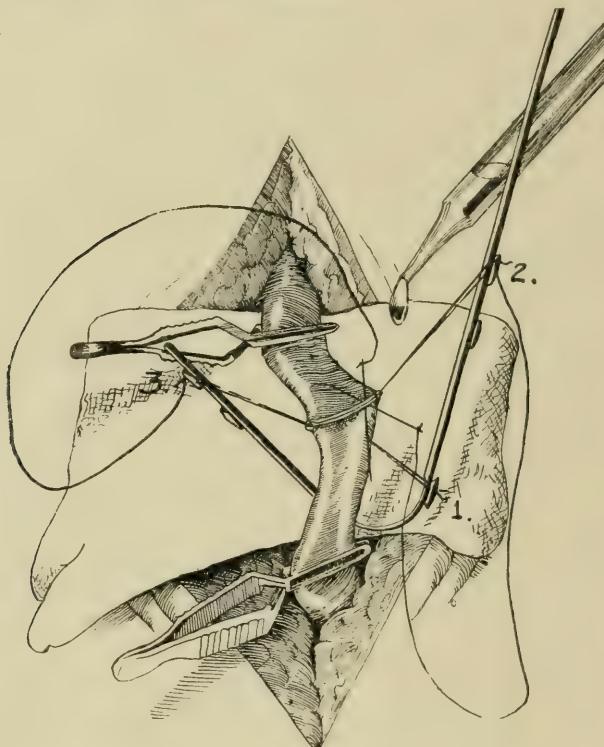


FIG. 16.—Tractor sutures have been placed, fastened to the buttons on the suture staff, and the suturing of the first third of the artery has begun. A double mattress suture is used. Olive oil is dropped on the suture line. (Horsley.)

Ligation of the External Iliac Artery and Vein Above and Below a Communicating Bullet Wound of These Two Vessels.—LaRoque⁷⁹ reports a pistol bullet wound of the left external iliac artery and vein, which he ligated above and below the wound within an hour after the injury. On the third day after operation there was distinct capillary response in the toes of the left lower extremity, and he made a perfect recovery. Sixteen weeks later the only abnormality was the absence of the pulse

⁷⁹ Annals of Surgery, March, 1921, p. 265.

in the popliteal artery and the arteries of the foot, and yet the extremity seemed perfectly supplied with blood. He discusses the advisability of immediate operation, and feels compelled to subscribe to the belief that it should be performed within a short time after the receipt of the injury, but it may be wise to delay the operation for a few hours or days to secure the services of a qualified surgeon or a properly equipped hospital and an aseptic operative field. In discussing the usual tests employed for estimating collateral circulation to determine the treatment of a bloodvessel injury, he warns against the fallacy of

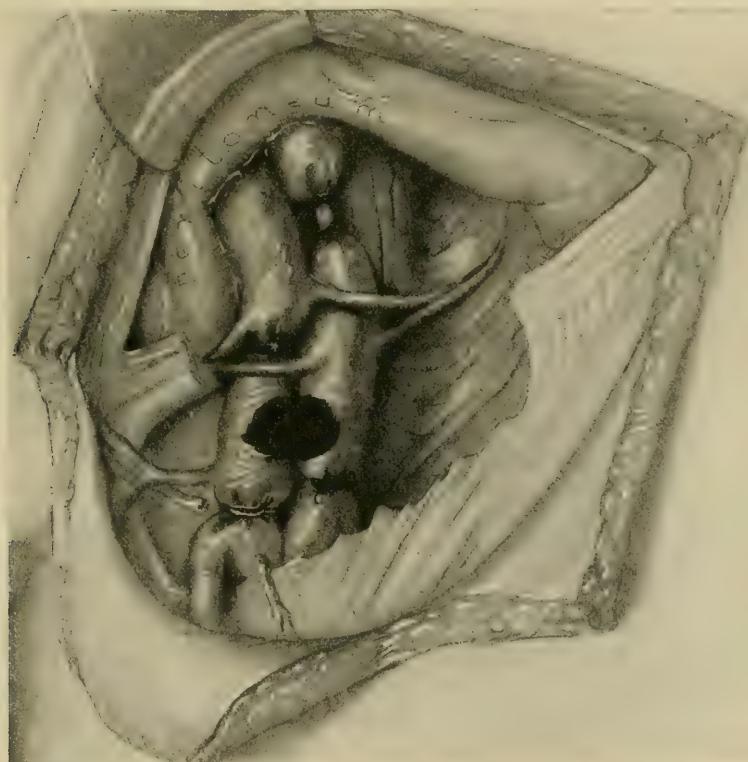


FIG. 17.—Ligation of the external iliac artery and veins above and below a communicating bullet wound of these two vessels. (La Roque.)

palpation of the peripheral arterial pulse as an indication of the future circulation of the extremity. Surgeons have known for years that frequently after injuries in the region of an artery in which the artery itself is not cut, there may be temporary obliteration of the pulse in the distal vessel. The recent observations of Leriche and the teachings of many years of Halstead⁸⁰ that spastic contraction of the artery occurs distal to the location to such slight trauma as is incident merely to the handling of large bloodvessels which result from irritation of the

⁸⁰ Johns Hopkins Hospital Reports, 1920.

periarterial sympathetic nerves. Matas⁸¹ has observed temporary obliteration of the distal pulse to an aneurysm in which, at operation, a patulous lumen of the artery was shown. Amputation, however, would seem indicated when the extremity is cold and pulseless, insensitive to pain as the result of extensive injury involving the main arterial trunk.

In emphasizing the necessity of approaching the vessel through an aseptic operative field, he is entirely in accord with results reported by surgeons from their recent military experience. We have expressed ourselves very positively about this in our review in 1919. He rather favors the control of hemorrhage by temporary ligatures of catgut or tape rather than the isolation of the vessel and the application of clamps, but the surgeons most experienced in bloodvessel work feel that clamps are the safest method. He advocates the débridement of devitalized tissue in order to minimize the dangers of infection which are so fatal in bloodvessels with the secondary hemorrhage and clot formation which is inevitable. There seems ample ground for the belief that all cases of thrombosis are due to infection, and that without infection, even in vessels of small caliber, thrombosis does not occur after a suture or total occlusive ligation. Further, there seems to be reason to believe that in the absence of infection, gangrene is never caused solely by ligation of any part of the external iliac or femoral arteries at a point above its communication with the sciatic through the branches of the profunda femora.

The next decision in such a problem is whether to suture or ligate the vessel. In LaRoque's case there was so much destruction of the lateral wall of the vessel, he feels it would have been impossible to employ lateral suture. After excision, there was a defect of slightly more than an inch to be bridged over by traction upon the ends of the arteries or by grafting a segment of the vein between the arterial ends. His summary of the experimental evidence indicates that suture by an end-to-end anastomosis would be the preferable procedure when dealing with the popliteal vessels, ligation of which is usually followed by gangrene. But, in the case of external iliac or common femoral arteries, it remains to be proved that quadruple ligation and extirpation in the absence of infection is ever followed by gangrene. The literature on the subject is too full of uninterrupted recovery following ligation of these vessels in which infection could take no part; and gangrene following ligation is so rare, even in cases in which infection was present, that it is not easy for one to believe that a vein graft or an end-to-end anastomosis is preferable.

The final question discussed is whether, in ligation, the corresponding vein also should be ligated, even though it is uninjured. Though we⁸² have previously reported the successful ligation of 8 consecutive cases of the femoral artery in which the vein was left alone, it seems the consensus of opinion that the safest procedure is to ligate both vessels simultaneously.

Halstead⁸³ states "We are compelled, I believe, to subscribe to the

⁸¹ Annals of Surgery, April, 1920.

⁸² PROGRESSIVE MEDICINE, December, 1917, 1918, 1919.

⁸³ Johns Hopkins Hospital Reports, 1920.

view that some degree of equilibrium of the arterial and venous systems must be maintained, granting this, there vanishes any difficulty that there may have been in accounting for the very high percentage of gangrene observed to follow ligation of the artery in cases of arterio-venous fistula. There is in these cases not only a great enlargement of the venous bed, but also a curtailment of the arterial tubage—a shrinkage or hypoplasia of the arteries distal to the fistula. Thus, even before the artery is ligated, the limb is handicapped by this lack of balance. When, now, the artery above a fistula is tied, irrigation with arterial blood is suppressed on one side of the capillary bed, and on the other side of it the mixed blood is deprived of a share of the pressure by virtue of which the life of the limb was partially sustained. It seems permissible to conjecture that, in some instances, the limb distal to the fistula may have been hardly less dependent on the pressure from the venous than from the arterial side, and, if so, we can more readily comprehend the ensuing gangrene than the frequent absence of it after ligation of the fistulated artery."

The clinical observations made especially by the English and French surgeons during the war that after ligation of the large arterial trunk of an extremity, gangrene was less likely to result if the companion vein was also ligated, is easily explained by the demonstration of Hooker that catabolic substances, such as are contained in the venous blood, cause dilatation of the capillary bed. Though, of course, highly toxic substances permanently retained would be undesirable, the great abundance and interinosulation of veins in the extremities makes it quite impossible to retain venous blood for a great length of time by ligation of even the largest vein.

Collateral Circulation.—Next to the saving of life through the prevention of hemorrhage, one hopes to save the limbs through the prevention of gangrene. The work of Seinor⁸⁴ and Hooker,⁸⁵ when studied together, are capable of throwing much light upon the maintenance of circulation in the area distal to the application of a ligature. If the reports of vessel ligations are ever tabulated it will be interesting to note the conformity of the clinical results with those which could have been anticipated through a comprehension of the origin, development and function of the bloodvessels and the application through clinical surgery of the basic laws of biology. It has been known for many years that in early embryonic life the arterial supply to the lower extremity is through an artery called the axial, the uppermost remains of which in the adult is the sciatic. The external iliac-femoral artery does not exist in the earliest stages of embryonic life, but is a later development from the embryonic umbilical artery, which in the mature fetus is the common iliac. Though the deep epigastric artery is apparently a branch of the external iliac, there are evidences of formation of the epigastric at an earlier period in the life of the embryo than the formation of the external iliac. Somewhat later the common femoral divides into two terminal branches, one of which, the saphenous, becomes the superficial

⁸⁴ American Journal of Anatomy, January, 1919.

⁸⁵ American Journal of Physiology, November, 1920.

femoral, the other persists as the profunda femoris. The femoral artery, therefore, though a later product than the primitive sciatic, grows with much greater rapidity and to a much larger size. Almost coincident with the division of the primitive femoral into its two branches, there develops from the primitive sciatic, which at this stage of the embryo is called the ischiadic portion of the axial artery (reaching all the way down the extremity to its terminal plexus in the foot), a recurrent branch called the rami communicantes. This grows upward, the developing femoral, and ends in a distinct plexus called by Senior the rete femorale.

Traumatic Myositis Ossificans.—Painter⁸⁷ believes that in the isolated cases, in which single traumas apparently act to induce ossification of muscle, these individuals may be of a type who, having escaped the progressive form of the disease, still have a tendency toward that type of transformation and react in that way to the stimulus of trauma. There is probably another type not so susceptible but with the same tendency, who, after repeated traumas, develop these changes in tendon sheaths and the attachments of certain muscles, as the tendon Achillis and the abductor longus muscle.

End-to-end Suture of Peripheral Nerves.—End-to-end suture of divided peripheral nerves is the final aim of surgeons. Cases presenting considerable loss of length of nerve substance and involving a space which apparently must be bridged for years have been treated by many ingenious, ill-advised and physiologically unsound devices. The experience of surgeons in the recent war and since, together with experimental work of Nageotte and Huber,⁸⁷ that end-to-end suture and free nerve grafts are the only methods which will restore function has finally eliminated the useless procedure. As a result, surgeons, instead of devising new and ingenious methods to bridge the gap in divided nerves, are bending their efforts to approximate the nerve ends and make possible end-to-end suture. Increased experience has shown that even after war injuries, which in general show a loss of a greater portion of nerves than follow civil injuries, only a very small percentage cannot be sutured end-to-end. In their first 10 cases "autocable grafts" were used, but in the latter cases only end-to-end suture was employed. They believe that all methods of securing end-to-end suture should be exhausted before any other method should be tried, and in their experience conditions justifying other procedures are very rare. In lesions of the large nerve trunks of extremities—the ulnar, medial, musculospiral, the great sciatic and its internal and external popliteal divisions—it is rare that end-to-end suture cannot be obtained.

Of the methods employed, they have found the following to be the most useful in obtaining apposition of the divided nerve ends.

1. Free mobilization of the proximal and distal portions of the nerve.

2. Transposition of the nerve to a shorter route than the normal one.

⁸⁶ Boston Medical and Surgical Journal, July 14, 1921, No. 2, **182**, 45.

⁸⁷ Surgery, Gynecology and Obstetrics, March, 1921, No. 3, **32**, 193.

3. Favorable posture of the extremity to shorten the distance to be overcome.

4. Gradual lengthening of the nerve by the two-stage operation.

He discusses in detail these procedures, the only new suggestion of which is the gradual lengthening of the nerve by a two-stage operation. In a small number of cases in which an end-to-end suture cannot be obtained at a one-stage operation he has found a more satisfactory procedure to consist in a two-stage operation rather than the resorting to a nerve graft and a one-stage operation. The fibrous ends of the proximal and distal nerves are overlapped as far as possible, taking advantage of all gains from posture. The fibrous ends are not resected but sutured firmly together in this overlapped position and the wound is closed. The posture of the extremity is maintained by casts or splints; later, gradual extension of the part is permitted until there is normal freedom of movement and the normal range of motion is acquired.

At the second stage operation, which is usually not performed until after an interval of two months, the scarred portion is resected and the end-to-end suture accomplished. The part is again put in a position of relaxation as in a one-stage operation. The effect upon the nerve of this lengthening process can be seen at the time of the second operation. The nerve above and below the lesion shows some attenuation and some decrease in the size of the bundles above and below. Their results have been very much better by this method than after autologous grafts.

Myxoma and Chondromyxoma of Bone.—Among the 270 bone tumors which Bloodgood⁸⁸ has studied, he classified 12 as myxoma; 9 of these are pure myxomas and 3 are chondromyxomas. Of the pure myxomas, 2 were periosteal and 7 central tumors. Of the chondromyxomas, 1 was periosteal, 2 central. The myxoma, therefore, is more frequently a central tumor of bone. The combination of myxoma and cartilage is relatively unfrequent; he has found 7 examples of chondromyxoma as compared with 14 pure chondromas, 7 periosteal and 7 central. However, when a tumor resembling cartilage is exposed, there is always a possibility of myxoma, and its presence should be determined at once by a frozen section. Bloodgood has not been able to find, up to the present time, the record of a single case of myxoma or myxochondroma which has remained well and free from recurrence after an operation consisting of curetting only. Bloodgood has repeatedly called attention to the malignancy of myxoma of the bone. They are rare tumors, occurring both periosteally and centrally, and in the beginning they may be small and can frequently be removed without sacrificing the limb by amputation.

There is no way to make a diagnosis of the condition without an exploratory incision. The same danger accompanies a piecemeal removal of the tumor as does the removal of all malignant growths, and there are a number of cases on record of such recurrence. He reports several cases in this article and refers to one previously reported by Codman.⁸⁹ Therefore, it is of the utmost importance to have in mind,

⁸⁸ Annals of Surgery, December, 1920, No. 6, 72, 712.

⁸⁹ Boston Medical and Surgical Journal, February 25, 1902, p. 211.

if attempting a conservative exploratory operation, a technic which will prevent, or minimize, the possibility of recurrence by operative transplantation of tumor tissue into the uninvolved tissues. Bloodgood suggests that if, upon exploration of a bone tumor, it proves to be a cyst, it should be merely curetted, the bone shell should be undisturbed and the wound closed without drainage. If a giant-cell tumor, it should be curetted thoroughly, swabbed with pure carbolic acid followed by alcohol, and the wound closed without drainage. If the tumor proves to be a chondroma with myxomatous areas, the same method should be employed as for giant-cell tumors, but the wound should remain open and radium placed in it and later the wound closed. If the tumor proves to be a myxoma or contains myxomatous tissue, he advises curetting, preferably with a cautery, this to be followed by a swabbing with carbolic acid and alcohol, then packing the wound with zinc chloride gauze which is left in for twenty-four hours. Following this, the wound should be closed and the case watched most carefully. He admits that there are no cases on record at the present time to prove the efficacy of this treatment of bone tumors containing myxomatous tissue, but, as the myxoma recurs first locally, amputation could be done as soon as there is a recurrence.

Metastatic Malignancy of the Bone.—Fraenkel, von Recklinghausen, and others, have described two types of secondary bone metastasis, the osteoclastic and the osteoplastic. The osteoclastic form is characterized by marked lacunar absorption and destruction of bone, causing an extreme porosis of the osseous tissue. The osteoplastic form is characterized also by lacunar absorption, but there is a marked thickening of the bone due to the collection of the malignant cells and a secondary calcification around the malignant process. The two types are found quite frequently in the same bone. The roentgenogram shows extreme decrease in density in the osteoclastic form, the bone having a honeycombed appearance. In the osteoplastic form the roentgenogram shows an irregular increase in bone density, the bone having a chalky appearance, without cortical or periosteal thickening. Pfahler has called attention to the frequency with which the osteoplastic form follows in cases of carcinoma of the prostate, while the osteoclastic is most frequently found as a secondary growth in carcinoma of the breast. Moore,⁹⁰ from his group at the Mayo Clinic, feels that the metastasis occurs usually by way of the blood. The sources of the metastasis in his group of cases were as follows:

Breast	36
Prostate	11
Kidney	7
Thyroid	2
Vulva	1
Sigmoid	1
Uterus	1
Abdominal masses of unknown nature	3
Primary source not discovered	3

⁹⁰ Collected Papers of Mayo Clinic, 1919, 11, 1066.

The usual statistics quoted in literature place carcinoma of the thyroid second to carcinoma of the breast as source of bone metastasis. The metastasis were located as follows:

Spine	22
Pelvis	11
Femur	9
Ribs	6
Humerus	6
Clavicle	1
Sternum	1
Radius	3
Skull	3
Tibia	2
Bones of hand	1

In a review of the clinical histories, the most common symptom was pain, a pain that resembles neuritis; it is almost always constant and is referred along the course of the nerve trunks. It is often remarkable that, in spite of extensive areas of involvement, the patient is able to move without apparent inconvenience. A case in which we have recently had under our care a lesion in the cervical, another in the lumbar spine, did not incapacitate the patient until a third lesion developed in the femur which resulted in a fracture. Spontaneous fracture is a fairly common occurrence. It was noted in 6 of their 65 cases.

The Treatment of Acute Staphylococcus Osteomyelitis.—Last year we referred to Tuffier's enthusiasm for the vaccine treatment of osteomyelitis in preference to operative procedure. Several references are found to this in the recent French literature. Miginiac⁹¹ refers to this procedure and says that there is at present a discussion of the possibility of avoiding radical surgical procedures by the use of vaccines. This was at first attempted by causing an "abscess of fixation," that is, by the injection of turpentine, causing an abscess to form at the site of the injection. A newer method now employed by the French is the injection of autovaccines, made from the pus of the patient or from a patient having the same kind of infection. The method is only used thus far in staphylococcus infections, and will not give good results if the infection is very virulent. Gregoire has reported 17 successful cases, Miginiac records 3. He says that if there is necrosis of bone it is useless to give a vaccine. In view of the fact that necrosis of bone occurs so promptly in what is pathologically a panosteitis it would seem to us questionable whether an autogenous vaccine could be prepared before necrosis takes place.

Acute Hematogenous Osteomyelitis.—Bancroft,⁹² in an attempt to experimentally reproduce osteomyelitis in dogs by the implantation of croton oil, produced a marked necrosis of the surrounding bone, and what he calls a chemical osteomyelitis resulted. A sequestrum, often 5 to 10 cm. in length and including the entire shaft, frequently occurred. This sequestrum was separated from a newly formed involucrum by a

⁹¹ Toulouse méd., March, 1921, **22**, 121.

⁹² Annals of Surgery, June, 1921, No. 6, **63**, 681.

zone of débris and leukocytes; thus, all the pathology of an acute osteomyelitis was present with the exception of bacteria and their by-products. The interesting observation was made, in the prolonged experiments, that in the roentgenographic studies there was a gradual disappearance of the sequestrum, so that at the end of two months it was impossible to detect its former outlines by the *x*-ray. Microscopic sections taken at this time (Figs. 18 and 19) show the disappearance of the zone of separation, and that the former sequestrum was united to the living bone by bloodvessels entering the Haversian canals.

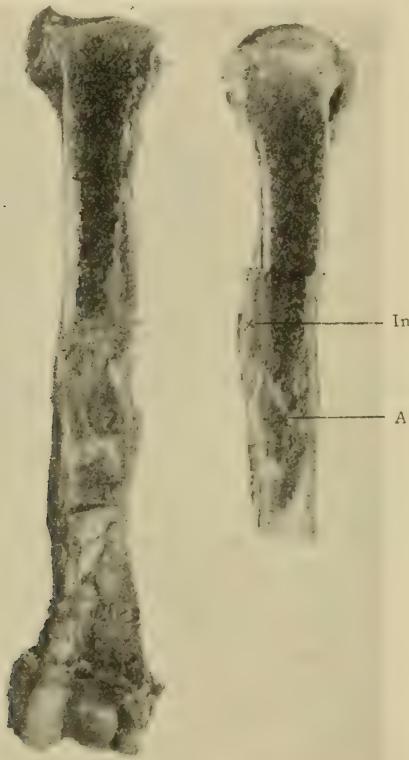


FIG. 18.—(Path No. 5942)—Killed January 24, 1920. Photograph of cut section. In, subperiosteal bone proliferation; A, probable remnants of old sequestrum, but no separation zone. (Bancroft.)

The process was similar to that found in a bone transplant; gradual absorption and deposition of new bone occurring throughout the Haversian canals until the dead bone had been replaced. If, in the absence of bacteria, dead bone does not act as a foreign body which must eventually be extruded, but as a scaffolding, about which new bone is deposited, our present surgical treatment of osteomyelitis will have to be revised. Bancroft believes that the clinical course and results of 12 cases occurring in the service of Poole warrants him in stating that it is possible to sterilize necrotic bone, resulting from acute hematogenous osteo-

myelitis, with Dakin's solution and thus avoid the necessity of removing more bone at operation than is necessary to provide adequate drainage of the pus under tension.

It is to be hoped that this experimental observation will be promptly confirmed, but for the present at least we cannot advise such conservative treatment of necrotic bone. We have been peculiarly interested in the problem of osteomyelitis during the last three years, and in a group of over 47 completed clinical cases regret to report our failure to

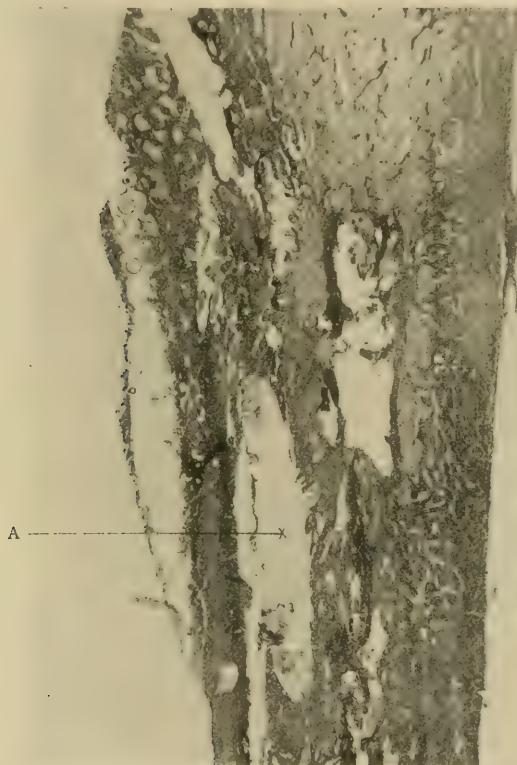


FIG. 19.—Microscopical section (Path. 5942). Subperiosteal bone proliferation. No zone of separation. A, spaces in which capillary tube lay. B, artefact occurring during decalcification. (Bancroft.)

sterilize the necrosed bone as Bancroft reports in his series. Nor can we shift the blame to the resident physician, for the operating surgeon has personally taken charge of the postoperative treatment, which has uniformly consisted in the use of Dakin's solution. While we will try to confirm the experimental work of Bancroft and obtain sterilization of necrosed bone, it has been our observation that the average surgeon at the present time errs in removing too little, rather than too much, bone. Inadequate drainage is the too frequent cause of unjustifiable mortality and an unnecessary amount of necrosis.

Acute Osteomyelitis in Children.—Pfeiffer⁹³ read a paper before the Philadelphia Pediatric Society, and epitomized this problem in such a complete way that it will be quoted at length. That in the group of 35 cases reported there was a mortality of 14.3 per cent, and only 14.3 per cent were discharged cured after an average stay in the hospital of over five months, in a medical center like Philadelphia, is evidence to show that either the diagnosis is extraordinarily difficult, or that the profession is not acting on the knowledge that acute osteomyelitis is an emergency surgical condition. In this series, over one-third had been erroneously treated on a mistaken diagnosis before admission to the hospital; 6 for rheumatism, 4 for abscess, 1 for dislocation and 1 for fracture is the usual average of errors. The truth of the matter seems to be that the disease, being relatively uncommon, catches the physician napping. There should be no reason to attribute the local condition to sprains, fractures or dislocations, even with a history of trauma, since the systemic and local conditions clearly point to infection. The most frequent and serious error is to consider the affection as one of the joint or of the soft parts.

To avoid error and delay, it is necessary to regard as osteomyelitis all acute febrile cases, especially in children, who have pain and inflammatory changes in the region of epiphysis. This is particularly true of the femur and tibia. The *x-ray* does not show early bone changes in osteomyelitis, and it is not only useless but dangerous to rely upon it in the acute critical stage.

The clinical symptoms, he emphasizes, are extraordinarily varied. Pain is ordinarily the initial and most prominent early symptom, and constitutional evidences of infection are usually present and rapidly increase, often in an alarming fashion. The general symptoms of pyogenic infections are the rule—fever, rapid pulse, very high leukocytosis, chills and sweats. The local symptoms and general symptoms usually increase *pari passu*. Effusion is frequently noted in the neighboring joints. If the process is allowed to continue without surgical interference, in a few days or more fluctuating abscesses of the overlying soft parts may form, and the inflammation will extend throughout the whole length of the bone.

The further course of the disease, if it is not subjected to radical treatment and the patient does not succumb to sepsis, is that of the discharge of the abscess of the soft parts with continuance of separation of the affected bone and adjacent tissues, sequestrum and involucrum formation with the development of chronic sinuses that remain open or heal only to break down with renewed suppuration. The drift of such cases from hospital to hospital during the greater part of their life not only seriously incapacitates by the local lesion but their life expectancy is cut short by the continuous absorption of the septic products. His analysis of this group of cases corresponds in a surprising way to that found in the usual text-book. Thus, it was more frequent in males, and its greatest incidence was in the latter years of childhood.

The long bones were more frequently involved. The femur usually leads the list and the fibula is a close second.

In considering the etiology, the disease is always an infection, and in this series, as in all others, the most common infecting microorganism was the *Staphylococcus aureus*. The streptococcus, *staphylococcus albus* and the *pneumococcus* are frequently causative. Bacillary infection also occurs, notably with the typhoid bacillus.

As in many other infectious diseases, the depreciation of the immune forces of the body seem to play a considerable role in predisposing to the attack. Previous illnesses, exposure to cold or wet, as prolonged swimming, malnutrition and rachitis are frequently encountered. In about one-third of the cases definite suggestions as to the portal of entry were noted. It is obvious that osteomyelitis of this type is a hematogenous infection; therefore, bacteremia must precede the localized process, such as may arise from antecedent tonsillitis, pharyngitis and other oral infections, bronchitis, influenza, pneumonia and pustular conditions of the skin.

Certain conditions would seem to induce local implantation of the circulating infective agents. In Pfeiffer's series, 43 per cent gave a direct history of traumatism. It must be remembered, however, that a history of traumatism can nearly always be obtained from children and young adults. Trauma acts by external injury of the bone. Force of sufficient violence applied to a bone breaks the dense cortical layer and produces a fracture. Force of insufficient violence to produce a fracture may still injure that marvellous system of arches and cross braces, which give to the spongy bones their strength and lightness. As has been pointed out, these arches and braces develop along and in answer to lines of strain. A sudden force and quick deformation of the medullary arches can injure and even fracture these delicate supports without fracturing the cortical bone. This can happen most easily in childhood when the cortex is elastic and yielding. Moreover, during the period of growth, the bone immediately adjacent to the epiphyseal cartilages is young and delicate and most susceptible to trauma. It is well known that, in the vast majority of cases, acute osteomyelitis begins in the shaft of the long bones near the epiphyseal plate, a region known as the metaphysis. Lexer has shown, by means of *x*-rays taken of bones whose nutrient bloodvessel had been injected with an opaque substance, that there is a rich blood supply in this region, most of which does not come from the nutrient artery but from vessels which encircle the growing end of the bone and send branches of considerable size directly to the epiphyseal plate and the adjacent medulla. These branches break up into numerous wide capillaries in which the blood current is slowed and ample opportunity is given for the interchange of metabolic substances upon which the growth of the bone depends. From Langer's work we have come to accept certain growth coefficients for the various bones of the human skeleton which represent the relative ratio of growth of bones from the various epiphyses. The bones possessing the highest growth coefficients are the femur and the tibia. These are the bones most frequently affected by osteomyelitis. Further,

Klemm has shown that in the same long bones the most frequent site of infection is at the end possessing the most actively growing metaphysis. Formerly typical osteomyelitis was often called epiphysitis under the false impression that the epiphysis was the primary focus. True epiphysitis, however, is prone to extend into the joint rather than into the shaft. The anatomical explanation is that the periosteum grows into the epiphyseal line and does not extend over the epiphyseal cartilage.

There is no disease of which it can be said more truly that the treatment is wholly surgical. Medical treatment of the patient may be required, but not of the disease itself. The physician has but two functions, namely, to recognize the conditions and to secure prompt and adequate surgical treatment. The earlier the operation, the better the outlook for life and limb. The essential object of surgical treatment is prompt and efficient drainage of the affected medullary cavity. The surgical error, that is frequently committed even when operating in the acute state, is to incise and drain only the soft part and the periosteum, leaving the medullary cavity of the bone unopened. Three of Pfeiffer's 5 fatal cases were operated upon in this way upon the third day, and another upon the fifth day of the disease. All of them died from sepsis after five days to two weeks. It is obvious that efficient drainage of the medullary cavity where the infection already arises cannot be secured by incision which reaches only to the cortex. Failure to open the bone cavity not only insures a local extension but makes certain general sepsis. Often an extensive collection of pus will be found under the periosteum and the beginner will be deceived, believing that the condition is a suppurative periostitis. This pus has always come from the interior of the bone, making its way out through the vascular channel and along the line of the epiphyseal cartilage.

Pfeiffer advocates the opening of the bone in every case of acute osteomyelitis, and with this we entirely agree.

One should not be content with a simple trephine or burr opening, but the cortical bone should be removed overlying the involved medulla for a distance of at least two inches and beyond all macroscopic infection of the marrow. There is much more danger of making the incision, both in the soft parts and the bone, too small rather than too large. Large incisions, properly placed, do not incapacitate. Insufficient drainage and resulting necrosis often produce irremediable damage. Pfeiffer advises against the curettage of the marrow in the acute stage. We also agree with this warning for, if it is exposed freely, it will drain, and necrosis will be limited to a minimum. The resulting cavity Pfeiffer packs with paraffin gauze and, upon its removal, on the third or fifth day, he applies the chemical process of sterilization usually employed with Dakin's solution. If necrosis has not occurred, the cavity will be readily sterilized, and secondary closure can be practised according to the accepted method. If necrosis has occurred the problem becomes one of chronic osteomyelitis which he does not discuss.

Persistent Bone Sinuses.—Peabody⁹⁴ has had the opportunity of observing 500 persistent bone sinuses following gunshot wounds. He very properly says there are several reasons for avoiding the word osteomyelitis. "Persistent bone infections" or "bone fistulae" follow-

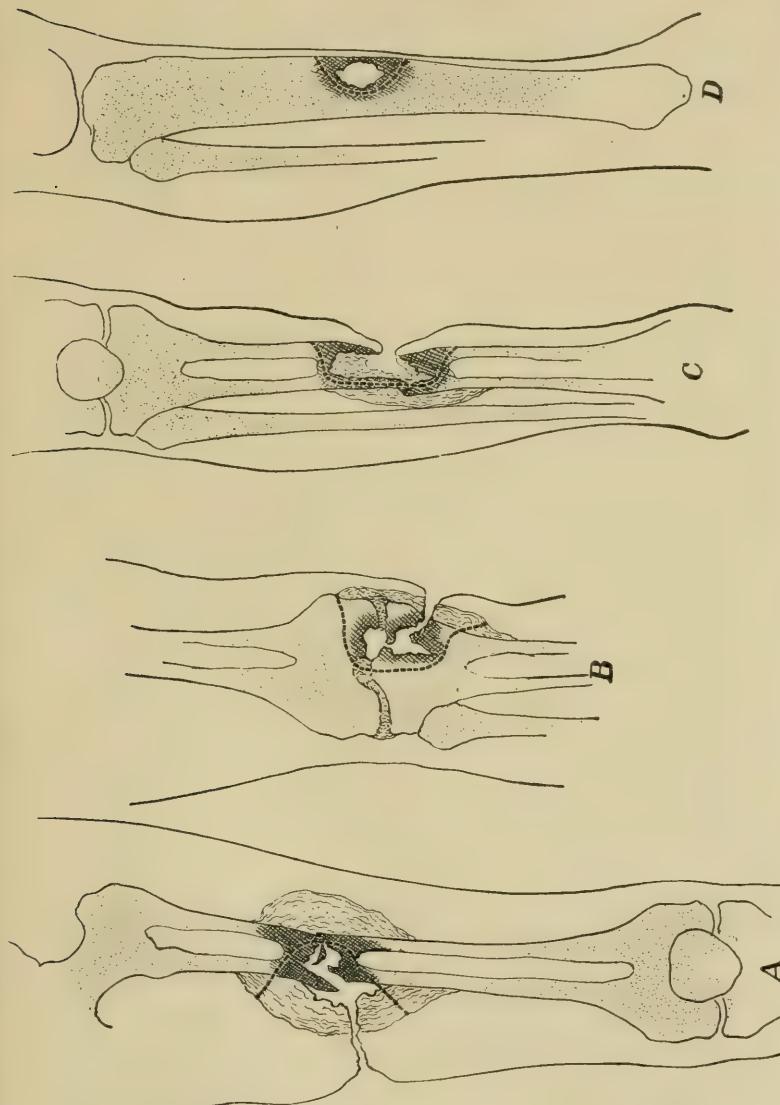


Fig. 20.—*a*, Schematic drawing to show common type of fracture with slight displacement, large callus, central cavity with sequestrum, absorption of spicule, and sinus to surface. Dotted line indicates extent of bony excision. *b*, Illustrates old T-fractured tibia with unabsorbed cartilage in joint. Excised ankylosis. *c*, Common type of cavity undemining cortex of tibia and line of excision. *d*, Incomplete fracture from seton wound and through-and-through sinus in crest of tibia. Persistently recurred until converted into groove as outlined. (Peabody.)

ing gunshot wounds is quite a different problem than suppurative osteomyelitis of civil life. In our previous reviews we have referred to Chutro's work on this problem, and it has a definite bearing upon the

⁹⁴ *Surgery, Gynecology and Obstetrics*, November, 1921, No. 5, 31, 512.

type of cases resulting from industrial accidents, where septic compound fractures develop persistent sinuses and refuse to respond to the usual treatment. He reports operating upon 250 of these cases under his direction, but, as it was in army hospitals which were being rapidly abandoned, his statistical evidence is not perfect. The one characteristic which all of this group of cases had was, as Chutro has pointed out, an infected bone, cavity with uncollapsible, unregenerative walls. In civil practice is it not uncommon to see the so-called "Brodie's abscess" evacuated, and then closed and apparently fill with regenerated bone. Leriche believes that the infectious process present in cavities following traumatic infection limits the power of the bone to regenerate. In the past the integrity of this bone chamber has been accepted and a cure attempted by plugging with various media. Various materials suggested in the last fifty years are sufficient evidence of their worth. Twenty years ago Watson-Cheyne introduced the theory of obliteration of the cavity by the absorption and replacement of blood clot, but the susceptibility of blood clot to infection precluded its use in this type of case. The conversion of the cavity into an open gutter was first advocated by Broca, later by Sergeant, White and Chalier. Jacob, of Belgium, at the end of 1917, first devised the method of radical revision of the bony cavity, and this method has subsequently been emphasized by Chutro, Dehelley, Moschowitz and Martin. We have already reviewed this in detail, both in 1919 and 1920. The illustration shows the mechanics of the operation (Fig. 20). He concludes that the presence of an infected bone cavity was the underlying cause of the persistent sinuses present in these 500 cases, that by a revision operation, which removed all overhanging surfaces of the cavity and converted it into a flat trough or saucer, was the first step required in order to eliminate faulty configuration. When this was properly performed, the concomitant infection was usually effectively controlled and terminated in a comparatively brief time by careful wound treatment based on the principles of the Carrel-Dakin, and, finally, after the proper configuration of the bone cavity had been made and the wound sterilized, it was possible, and usually desirable from a functional standpoint, to close the wound by some form of a radical reconstructive operation.

Plastic Procedures for the Obliteration of Cavities with Non-collapsible Walls.—Kanavel⁹⁵ has written concerning this interesting surgical problem in his usual inimitable way. It is sometimes forgotten, he says, that a cure in patients with non-collapsible cavities can be secured only by respecting well-known surgical laws of repair of tissue. The walls of cavities must come in contact with one another or with other living tissue, or must be so close together that proliferating cells from their walls can ultimately meet. In the latter instance it is well known that there is a limit to epithelial proliferation, because of the fibrosis which takes place wherever granulation tissue is formed. Just how large a cavity can be filled by the proliferation of epithelial cells cannot be stated definitely as it varies with the vascu-

⁹⁵ Surgery, Gynecology and Obstetrics, May, 1921, No. 5, 32, 453.

larity of the part and such other factors as the nature of the infection, and the body resistance. Where it is possible to secure collapse of a cavity by removal of the entire wall, this is the procedure of choice. The next method, as we have referred to in our review in PROGRESSIVE MEDICINE in December, 1920, is the removal of more than one-half of the circumference of the wall. If these simple measures fail, or if the nature of the structure is such as to prevent collapse, the transplantation of living tissues from the same individual, preferably with a pedicle, will often be of the greatest benefit. In porencephalic cavities, he employs free transplants of fat and he recalls no failures. In osteomyelitic cavities he has practically always failed when using free fat transplants and feels that it is due in large part to the poor blood supply of the walls of the cavity. He reports a case of a cavity in the lower

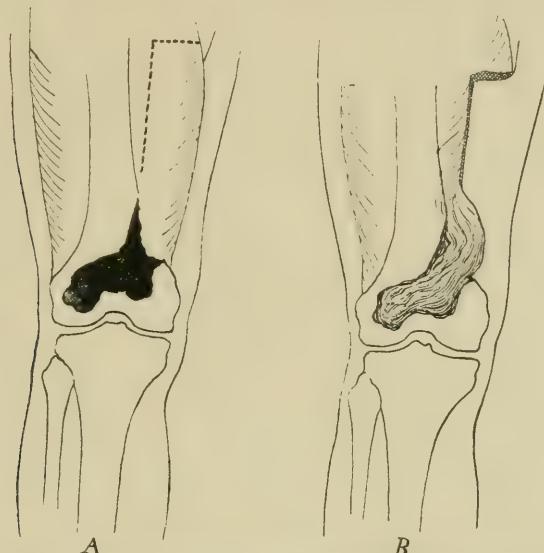


FIG. 21.—Mr. R. S. Showing obliteration of cavity filling entire lower end of femur.
(Kanavel.)

end of the femur, the result of old osteomyelitis involving practically the entire head of the bone down to the articular surface. If one had attempted to remove the wall, the joint would certainly have been destroyed. At the operation, the cavity was curetted and the overhanging edges removed. A flap of muscle taken from the edge of the quadriceps extensor, with its base downward, was turned into the cavity so as to obliterate it (Fig. 21). Four years later the wound was healed and the man had been taking active part in athletics.

Chronic Circumscribed Osteomyelitis.—Stern⁹⁶ discusses the type of osteomyelitis which runs a chronic and circumscribed course. At the onset the patients are not aseptic as in the usual acute osteomyelitis; the temperature falls quite promptly and all the local symptoms tend

⁹⁶ Journal Orthopedic Surgery, April, 1921, 3, 132.

to disappear, the pain and disability and the periosteal thickening of the bone alone remaining more or less permanent. Apparent healing may take place and last for years; in some there may occur periodic recrudescences. The condition at times becomes multiple and often involves symmetrical bones. The most striking clinical feature is the relatively enormous induration of the bone and periosteum around these abscesses. The induration may be so circumscribed and develop so steadily that a suspicion of sarcoma of the bone is aroused. Roentgenographically the lesions are sharply marked ovoid areas of bone necrosis, usually in the ends of the diaphysis of long bones, especially of the tibia. At operation, the bone walls of the necrotic areas are usually eburnated and the cavities filled with pus, granular bony detritus, granulation tissue, and the walls are often lined with dense pus membranes.

With the foregoing we entirely agree, but his advice as to the treatment we cannot accept entirely. The walls should be chiselled away, but in a definite manner, as first suggested by Broca, so that less than one-half of the circumference of the resisting bony tissue remains. The affected medulla and the dense lining membrane of scar tissue should then be removed, and if all this is done and the wound sterilized by the Carrel-Dakin technic, there will be no need of employing Mosetig's bone wax.

The Role of Cancellous Tissue in Healing Bone.—Todd⁹⁷ has for some years been interested in the study of bone growth and metamorphosis, and the present paper summarizes the result of an inquiry into the regeneration processes of the cancellous tissue of human long bone as revealed by the cases of chronic osteomyelitis which came under his care while in charge of a military hospital in Canada. The cases studied were all chronic and presented the difficult type of bone cavities. His practical interest in this problem was first to secure methods for rapid and satisfactory healing of the bone cavity and a prognosis regarding the probable duration of the patient's stay in the hospital. He assumed that the only solution of the problem lay in an adequate knowledge of the role of the cancellous tissue. He is peculiar in this respect, because most surgeons have, from experience, felt that they could depend very little upon the regeneration of the cancellous tissue, particularly in chronic osteomyelitis, and have devised methods of filling the cavities with muscle and fat as we reviewed in the December, 1920, number of PROGRESSIVE MEDICINE, or have resorted to the removal of sufficient roof and side walls to allow a collapse of the adjacent soft tissues, as first suggested by Broca, and reviewed by us in the December, 1919, number of PROGRESSIVE MEDICINE.

Todd's description of the histological features of a typical healing bone cavity are as follows: Within a few days after operation, which consisted in a thorough opening and adequate drainage, the entire cavity seemed to be lined with vascular granulations, which are of the earliest and strongest growths where the remaining cancellous

⁹⁷ Annals of Surgery, October, 1920, No. 4, 72, 452.

tissue is thickest, and especially in that part of the cavity nearest the midpoint of the diaphysis of the bone. A portion of the new vascular tissue, carefully removed under a local anesthetic two weeks after operation, shows active growth of bone; and apparently the greatest bone growth occurs where the cancellous tissue is most abundant. Invading the connective tissue are trabeculae of recently formed bone, each trabecula having arranged along its surface numerous osteoblasts, and the histological picture is that of bone growth. Todd claims that, given satisfactory conditions, the regeneration progresses steadily until the bone cavity is filled, the rate varying, however, with the particular bone, the location in the bone, the size of the cavity, and possibly the age of the patient. It is in the latter stages of the filling of a large cavity that the processes of growth slacken in speed. That cancellous tissue is a generous source of osteoblast, Todd feels has not been sufficiently recognized. We feel it could be more forcibly expressed by saying "not admitted." The usual procedure, in infected bone, of thoroughly curetting until only the compact shell remains, and then treating the remainder with carbolic acid, practically removes all cancellous tissue, and Todd claims that it is this type of bone cavity that we have so much difficulty in healing. Regeneration of bone from compact tissue is indeed slow, and may, for practical purposes, be considered as non-existent, and it is this type of bone which remains after the usual radical operation for acute and chronic osteomyelitis.

In summarizing his work, Todd claims: Cancellous tissue is one of the chief agents in regeneration of bone, and, like the cambium layer of periosteum, should be treated at operation in the most conservative manner consistent with thorough exploration and drainage. Septic bone cavities will heal from the bottom if the wound in the soft tissues is kept widely open until this has occurred. During these periods, the least possible mechanical disturbance of the cancellous tissues should occur, such as pressure by gauze or drainage tubes. No disinfection of the cavities should be attempted, for Todd believes this kills the remaining tissue from which regeneration is expected. This seems too vague a statement to be accurate, and, in our own work with osteomyelitis, we do not feel that the chlorine group of antiseptics has had any inhibitory effect whatever upon the regeneration of tissue. Nor can we understand why, in dealing with a focus of osteomyelitis, it is necessary to create a bone cavity. Mechanically, it is always possible to remove one half of the cortical wall and thus eliminate the mechanical difficulties of a cavity, while it is not at all necessary to destroy at this time the cancellous tissue of the remaining half. Such a procedure gives maximum drainage, avoids mechanical difficulties of filling a bony cavity by regeneration of tissue, and does not necessarily detract in any way from this regeneration of the cancellous tissue that Todd describes.

The Recognition of Dead Bone Based upon Pathological and X-ray Studies.—A very timely contribution by Phemister⁹⁸ is his article upon the x-ray interpretation of dead bone. We have all been disappointed

⁹⁸ Annals of Surgery, October, 1920, No. 4, 72, 466.

in our roentgenograms, in acute destruction of bone and in chronic infections, by finding that the bony lesions are usually far more extensive than is shown by the *x-ray*.

The points by which we distinguish between dead and living bones in the roentgenogram are density, demarcation and contour. The density of dead bone is greater than that of an equal volume of surrounding living bone. It retains its original compact texture. Living old bone

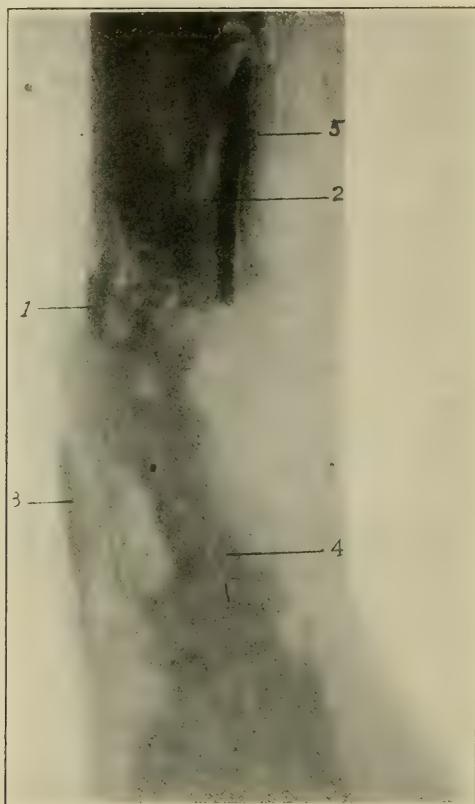


FIG. 22.—Gunshot fracture of 1, femur seven and one-half months old, showing extreme variations in density of dead bone, new bone and old living bone. Dense uneroded sequestra, 1 and 3, uncovered by involucrum; eroded sequestrum, 2, covered by involucrum; 5, thin sequestrum; 4, seen on flat and identified by its fracture line. Photograph in Fig. 23.

has its density evenly reduced by atrophy, and is occasionally streaked by dilated longitudinal cannular markings. Newly formed bone is of low density and spongy in character (Figs. 22 and 23). The differences in density are striking in this case. Eight sequestra were removed. Fig. 23 is a photograph of four of the large ones that can be easily identified in the *x-ray* and of a piece of involucrum (5) that encase sequestrum No. 2, the surface of which is markedly eroded, while that of Nos. 1 and 3, which were not covered by involucrum, are smooth.

No. 4, presenting a flat surface, was identified by its sharp fracture line. There are many variations from these general statements; dead bone when extensively eroded has the density of its shadow reduced, which may be equal to or below that of the living bone, but is distinguished from the latter by its blotchy, uneven character. Secondary sequestra usually shows no variations in density from the adjacent bone. The line of demarcation between dead and living portions is usually sufficiently wide and clean-cut to be of great value in diagnosis, but any oblique or tortuous portions, especially when overlapped by heavy bone, may be indistinguishable or very imperfectly made out. Notches or

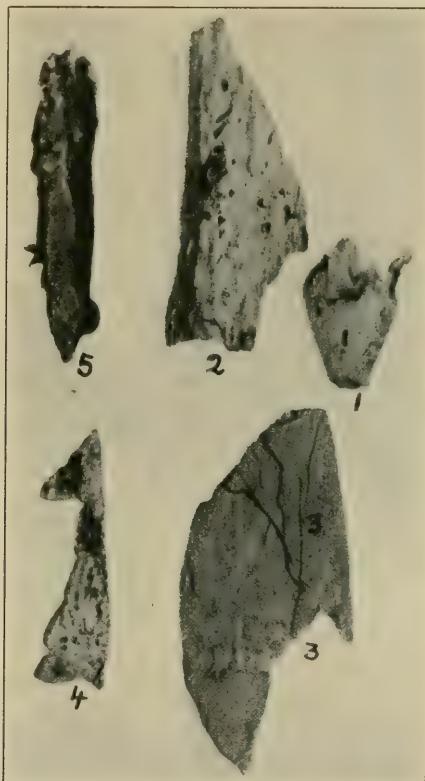


FIG. 23.—Sequestra from case shown in Fig. 22. Numbers same, but pieces reversed.

unevenly streaked or dotted lines may indicate complete separation of the dead piece. The outline of the sequestrum is of great diagnostic value. Its surface is smooth, sharp and straight where unattached, but irregular and jagged where erosion has occurred. Sharp spicules, especially about the ends, are frequently seen. The compact texture of dead bone gives its outlines a sharpness that the less dense and frequently growing living surfaces do not possess. Evidence of irregular destruction of spongy bone at the ends of the shaft in osteomyelitis is indirectly a pretty safe sign that dead portions are present, even though their outlines cannot be determined.

Early Changes following the Injection of Tubercle Bacilli into the Metaphysis of the Long Bones of Animals.—That tuberculous infection of the long bones usually originates in, and for a great part is confined to, the metaphysis and epiphysis is generally recognized. The explanations are many. The anatomical studies of Lexer suggest that the embolic deposit of bacteria is favored in this region by the anatomical arrangement of the arteries. Ely, on the other hand, claims that peculiarities in the structure of the bone marrow facilitates the growth of a tubercle bacillus. These experiments of Oliver⁹⁹ were undertaken to demonstrate the cellular reaction which follows infection with the tubercle bacillus, ignoring the question of the path of the infection. In other words, the bovine tubercle bacilli in an emulsion of 1 or 2 drops of normal salt solution were injected into the bone marrow through a trephine opening made in the metaphysis of the tibia of rabbits. Similar experiments were made with guinea-pigs, and also experiments were made with the human type of tubercle bacilli. After intervals of from three to nine days, the animals were killed, and portions of the bone excised for examination. The earliest changes were observed three days after the implantation. There were no macroscopic changes at this time but definite changes were observed with a low magnification. The high magnification showed that there was nuclear degeneration of many of the leukocytes, and there were also changes in the reticulo-endothelial cells. In sections stained for tubercle bacilli, it was usually possible to demonstrate one or more acid-fast bacilli. A few giant cells were also present. In several animals which were allowed to live a month, or until they died, extensive tuberculous lesions were found in the diseased bone.

Oliver concludes, from his experiments, that though Lexer's anatomical demonstration of the numerous bloodvessel anastomoses in the metaphysis of the long bones accounted for the arrest and localization of the tubercle bacilli in this region, it did not explain the localized lesions which developed when tubercle bacilli were the cause as contrasted with the diffuse lesions being in pyogenic infections. Oliver believes that these experiments show that the difference in the reaction of the tissue to the two types of organisms is due to peculiarities in the structure of the bone marrow. The tissue of the metaphyses of the long bones, as contrasted with the fatty marrow of the diaphysis, is rich in the cells which are particularly concerned in the reaction to infection with tubercle bacilli, namely, the reticulo-endothelial cells.

Paget's Disease of the Bones.—DaCosta¹⁰⁰ reports a case of Paget's disease in a woman, aged fifty-two years, in which there was cervical dorsal kyphosis, enlargement of the skull and the bones of the legs and forearms, with a deformity of the chest caused by abnormal curvatures of the ribs. It is a condition which is reported very rarely, only 250 cases being on record. The disease is neither neoplastic nor hypertrophic. The first obvious action is bone absorption, which causes enlargement of the Haversian canals with early transformation of the marrow into

⁹⁹ Journal of Experimental Medicine, 1920, **32**, 153.

¹⁰⁰ Surgical Clinics of North America, February, 1921, **1**, 47.

fibrous tissue. New osteoid tissue then forms and the bones usually bend. It may be localized to one bone but usually involves practically all, the long bones of the leg being generally the painful ones. The head enlarges, and the involvement of the vertebrae causes a cervical dorsal kyphosis, reducing the height sometimes as much as a foot. Men are more susceptible than women, and there is no racial predisposition. It usually begins about the age of fifty, lasts for a long time and is not fatal. It is generally considered as resulting from disease of the ductless glands. The disease is incurable.

Fractures Considered as Potential Deformities.—Henderson,¹⁰¹ in an address before the Southern Minnesota Medical Association, has reviewed the subject of fractures from the patient's standpoint. Every fracture has within itself the tendency to leave varying degrees of deformity, and every fracture, therefore, should be regarded as a potential deformity. In certain types of fractures, particularly those in the vicinity of joints, deformities are especially prone to occur, and from the perspective that a surgeon obtains, as these deformities eventually reach him, he is well fitted to emphasize some of the measures that should be used in their prevention.

Each surgeon, when confronted with a fracture, should make an exact diagnosis and base his treatment upon that diagnosis. With the general accessibility of the *x*-ray at the present time, the poor condition of the patient is probably the only justifiable excuse to offer for not taking a photograph at once. An *x*-ray should be taken of every fracture or suspected fracture, and the only possible exception, and that a temporary one, is the one stated above.

THE SHOULDER-JOINT. Fractures in the region of the shoulder-joint are usually followed by the disability of a lack in the motions of abduction and outward rotation. This disability may be due solely to periarticular adhesions or an imperfect reduction of the fracture. Adhesions are usually readily broken under an anesthetic, and, if this is followed by massage and active exercise, normal function may be obtained. If it is due to actual bony deformity, it is the fault of the setting.

In fracture of the anatomical neck, if reduction cannot be perfect without an open operation, a slight amount of displacement is permissible and an operation avoided, as in this type of fracture there is almost always good impaction, and union is sure to occur. The real danger lies in the limitation of motion that may follow. Confinement to bed for two weeks, with the arm abducted to a right angle and held in that position by a Buck's extension with a light weight attached, will provide sufficient union to allow the arm to gradually drop to the side. Abducting the arm to a right angle should be done by passive motion at least three times daily. At the surgical neck the tendency is for the pectoralis major, the teres major and the latissimus dorsi to draw the lower fragment inward. The supraspinatus, infraspinatus and teres minor, as opposed to the subscapularis, tend to abduct and outwardly rotate

¹⁰¹ Collected Papers of Mayo Clinic, 1919, 11, 1071.

the head and upper fragment. The tendency of the biceps and triceps is to pull the lower fragment up and past the lower ends of the upper fragment. Malunion in this position limits abduction and outward rotation. The same dressing of abduction to a right angle with Buck's extension for two weeks usually insures a good result. In the case of a bad intra-articular fracture, in which ankylosis or marked limitation of motion is unavoidable, the ankylosis should be allowed to occur with the arm in abduction at a right angle. The movement of the scapula on the thorax, when the head of the humerus is ankylosed at the right angle to the neck of the scapula, permits a very satisfactory range of motion for the arm.

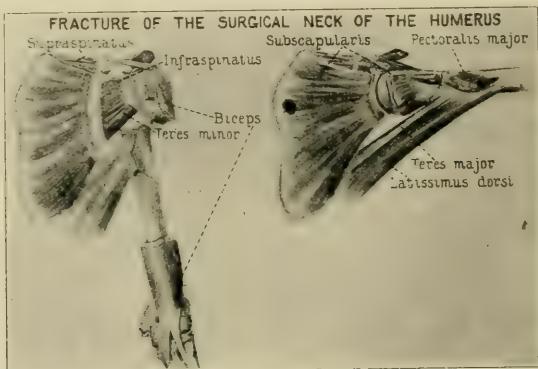


FIG. 24.—Fracture of the surgical neck of the humerus. (Henderson.)

THE ELBOW-JOINT. The common disability following fractures about the elbow-joint is the difficulty in flexing the elbow sufficiently to permit of dressing, as putting on a collar, or, in the case of a woman, dressing the hair. Henderson accepts without any reservation the precept of Sir Robert Jones, which is to the effect that all fractures about the elbow-joint should be treated with the elbow fully flexed and the forearm supinated with the single exception of fracture of the olecranon which requires full extension. After three or four days, when absorption of the immediate exudates is well advanced and repair has begun, and when, in particular, the muscles have come to rest, the elbow need not be so acutely flexed, but the forearm should be slung by the wrist close under the chin. Between the second and third weeks, when bony union is fairly secure, the wrist may be dropped two or three inches, and the patient may practice active movements daily, producing full flexion and then allowing the arm to fall down to the limit permitted by the sling. If this movement can be satisfactorily performed, the sling can be lengthened every two or three days until a right angle is reached, when it can be discarded altogether. Henderson refers to the right-angle splint only to condemn it.

THE WRIST-JOINT. Deformity and disability following Colles's fractures are not uncommon. The silver-fork deformity is almost always the result of inefficient reduction. The real test of the reduction

in Colles's fracture is the voluntary statement of the patient that he has felt it slip into place and it feels very much better. If reduction is complete, almost any splint will hold the fragments in position. Early use of the fingers should be encouraged, but he does not believe that the wrist should be used actively for about four weeks. This is much more conservative than has been our practice during the last two years. Passive motion of the fingers is begun on the following day. Active motion as soon as the pain will permit, while passive motion of the wrist is begun at the end of the first week and active motion permitted after two weeks. In many cases, where the reduction is perfect and there is definite impaction, no splint at all is worn and the patient carries the hand, wrist and forearm in a sling.

KNEE-JOINT.—The supracondylar fracture, or one in the lower one-fifth of the femur, so alters the line of weight-bearing in the knee as to cause serious disability (Fig. 25). Henderson claims if the separation of the fragments has been so extreme as to allow muscle to be

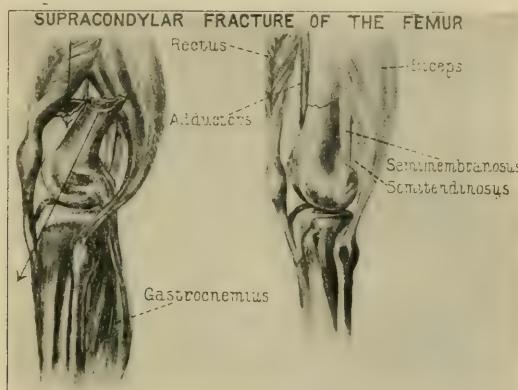


FIG. 25.—Supracondylar fracture of the femur. (Henderson.)

interposed between them, that conservative measures are almost invariably failures. He does not speak of the use of the calipers, which, in our experience, have been all that was necessary, but advocates open operation with subsequent fixation by metal or bone graft. He also refers in this connection to the separation of the epiphysis in children, in which the condyles of the femur are found on the anterior surface of the lower end of the shaft of the femur, with the articular surface looking directly forward. He says that it is usually necessary to expose the fragment by splitting the patella longitudinally, opening wide the capsule of the knee, splitting the posterior layer of the synovial sack, and, by direct manipulation and prying, to force the epiphysis back into its normal place.

Our experience with this type of fracture has been limited to a case which we reported in the *Annals of Surgery*, March, 1921, No. 3, 73, 382 (Fig. 26). Under ether anesthesia given several hours after the accident, the leg was flexed to a right angle with the thigh, and down-

ward traction in the axis of the femur, with increasing flexion of the leg, very easily reduced the fragment, as is shown (Figs. 27 and 28). This, of course, was a recent dislocation, but demonstrates that open operation is not always necessary.



FIG. 26.—Separation of the lower epiphysis of femur. (Lee.)



FIG. 27.—Separated epiphysis restored to place by acute flexion of knees. (Lee.)

THE ANKLE-JOINT. In fractures of the ankle-joint there is not infrequently a posterior displacement of the astragalus. An excellent study of this deformity by Downes was reviewed in the December number of PROGRESSIVE MEDICINE, 1919, and we reported one¹⁰² in which perfect reduction was not obtained until after tenotomy of the tendo Achillis. Anterior dislocation of the astragalus also occurs; a case of this type is reviewed on page 116. The common deformity

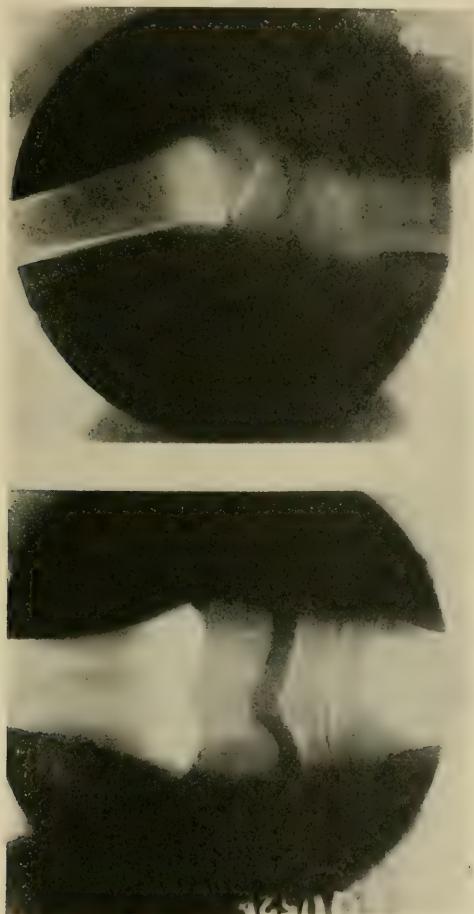


FIG. 28.—Ultimate result of case shown in Figs. 15 and 16. (Lee.)

after a Pott's fracture is a marked eversion of the foot with the weight-bearing line falling to the inner side. The resulting disability is great. The foot should be held in slight inversion; the ankle should be dorsiflexed to at least a right angle, and care should be taken that the posterior or anterior displacement of the astragalus is corrected. Weight-bearing should not be permitted under six weeks. The inner side of the

¹⁰² Annals of Surgery, March, 1921, No. 3, 73, 381.

sole of the shoe and heel should be raised about three-sixteenths of an inch, so that the foot will be held in slight inversion and maintained in this position for six weeks more. For heavy persons, Henderson advises an additional outside iron caliper splint (Fig. 29).



FIG. 29.—Brace to be used following Pott's fracture showing outside iron, inside T-strap and raised inside sole. (Henderson.)

Fractures.—Pritchard,¹⁰³ in attempting to make comparisons between the end-results obtained in the treatment of fractures before and after the period of the war, encountered the same difficulty that most of us have experienced in being unable to express them statistically because of improper classification and lack of uniformity in the records. He makes a plea for some standard method, as suggested by the American College of Surgeons' schedule for classifying end-results anatomically, functionally and economically, with a follow-up system. He seems convinced that functional and economic results are far more important to the patient and to the world than anatomical results, and it must be

¹⁰³ New York Medical Journal, April 20, 1921, 113, 610.

confessed that it is not essential to have a perfect anatomical result to obtain these two requirements.

Alonzo Myers¹⁰⁴ is just as positive that fractures, in which good functional results can be obtained by proper fixation and immobilization, should not be operated upon. Osgood¹⁰⁵ says that the one great outstanding conclusion from his experiences is that, in the early treatment of fractures of the long bones, the essential factor in relieving pain, securing alignment, maintaining fixation, and in general, minimizing shock, is traction. It should be immediately applied and maintained until union has begun and muscle spasm has ended.

THE TREATMENT OF FRACTURES OF SPONGY BONES. Long experience has taught surgeons that there is no single injury likely to lead to such long-continued or permanent disability, as fracture near, or through, the articular ends of bone. The mechanical disabilities are obvious, as when a fracture causes such displacement that the articular surface of one bone is no longer in relation with its fellow, or when hemarthrosis has led to inflammation and secondary adhesions within the articulation. When these mechanical conditions are not present, we are still without an adequate explanation. Nathan¹⁰⁶ calls attention to the close resemblance of the early roentgenographic picture of non-traumatic inflammatory conditions of spongy bones to inflammatory changes. Consecutive roentgenographic examinations of the bodies of the vertebrae, the tarsus and the carpus, demonstrate that the roentgenographic findings after injuries of these bone closely resemble those due to inflammations and infections in all stages of the process, so much so, in fact, that it is almost impossible to distinguish the decalcification, absorption, distortion, lipping, etc., of an arthritis of the spine, the carpus or tarsus, from the changes caused by trauma in these regions. The close resemblance between trauma and infection in these spongy bones is not confined to the roentgenographic findings. Intra-, peri- and para-articular effusion, causing distention of the capsule, compression of the muscles, tendon, nerve fibers and nerve endings in the neighborhood of the joint, are just as characteristic of traumatic as of non-traumatic condition.

These changes, of course, are not confined to the carpus, tarsus and vertebral bodies, but occur in all spongy bones. These morbid conditions are well known, as they occur, with their attendant arthritic phenomena, in the shoulder and elbow. The long-delayed recovery and great danger of permanent ankylosis following injuries to the elbow are almost classical examples of the condition. The fact that similar changes occur in the hip and knee, however, has not been sufficiently appreciated by the practitioner. It can be safely stated that trauma to spongy and cancellous bones, even when not sufficiently great to produce fracture, is likely to induce softening and absorption of the bone trabeculae. This pathological condition, under the stress of mechanical factors, leads to distortion of the affected bone; it is accompanied by peri- and intra-articular inflammation, and is apparently

¹⁰⁴ International Journal of Surgery, March, 1921, **34**, 90.

¹⁰⁵ Illinois Medical Journal, April, 1921, **39**, 242.

¹⁰⁶ American Journal of the Medical Sciences, April, 1921, Nos. 4 and 589, **161**, 585.

analogous to non-traumatic osteoarthritides due to infections or other as yet unknown causes. Experimental evidence which he obtained with dogs confirms these clinical deductions.

The relation of these clinical and experimental facts to treatment, he outlines as follows: Joint motion, after trauma or infection, may be lost or restricted because of three reasons: (1) Mechanical obstruction produced by displacement of the fragments; (2) cicatricial contraction or shortening of the tendons and soft parts because of the inflammatory reaction; (3) because the decalcification and absorption of the bone trabeculae, under the stress of mechanical conditions, has led to distortion, and, as a consequence, the joint surfaces are no longer congruent.

All things considered, after the fracture is reduced, the tissues should be splinted or immobilized until union has begun, after which locomotion with weight-bearing is the method of choice.

THE ABDUCTION TREATMENT OF FRACTURE OF THE FEMUR.—The unsatisfactory results which the conventional treatment of fracture of the neck of the femur still provide, for the majority of surgeons have not changed their methods, warrants a careful review of this article by Whitman.¹⁰⁷ The conventional treatment really is a pretentious sham, both in theory and in its practical application, and that it is not so generally recognized is probably because of the influence of custom and tradition. We have previously described this in our review of December, 1919, but it will be repeated at this time.

The patient, under general anesthesia, is placed upon a pelvic support provided with a perineal bar. When the fracture is complete, the trochanter is lifted to the normal plane of the femur and the shortening reduced by manual traction on the extended limb which, at the same time, is rotated inward to appose the fragments. Both limbs, in the position of extension, are then abducted to the full length. First on the sound side to estimate the normal range, and then on the injured side. As the limit of abduction is approached on the injured side, the tension of the capsule aligns the fragments in a horizontal plane and forces the fragment of the neck against the inner and resistant fragment of the head. This pressure of the fragments against each other is further supplemented by the contact of the trochanter and the side of the pelvis. A long plaster spica bandage is then applied, which, by fixing the limb in complete abduction, extension, and slight inward rotation, insures the continued effectiveness of the anatomical fixation of the fragments.

If the fracture is incomplete or impacted, Whitman advocates the breaking-up of the impaction, correction of the deformity, and restoration of the normal relations of the fractured surfaces and a plaster fixation dressing as described above. The correction of the deformity in this manner, instead of jeopardizing repair, as is usually taught, is the most effective means of promoting it.

The subsequent treatment, which is the same, of course, for all

¹⁰⁷ New York State Journal of Medicine, December, 1920.

forms of fracture, consists in raising the head of the bed one or two feet to increase the blood supply to the part and aid in repair. Such a dressing does not interfere with movement of the patient in bed—thus minimizing bed sores—nor of having him transported to the open air. In children they often are allowed to walk with crutches.

The spica dressing is worn for eight to ten weeks, or until it is assumed that union is sufficiently firm to permit movement of the limb. On its removal, the patient should remain in bed, devoting, if possible, several weeks to muscle reeducation and to the restoration of motion in the disused joints. During this time the limb should be drawn out to the limit of abduction at regular intervals by the attendant. Weight-bearing is not permitted until free and painless movement and the x -rays indicate that firm union has taken place. The treatment requires nearly a year, and, if earlier locomotion is demanded, a supporting hip brace should be applied.

Conventional treatment, if attempted with even a pretense of surgical efficiency, requires constant and skilled attention, much of which is expended on the prevention and care of bed sores. Practically, this can only be received in a hospital and at the present time there is no adequate provision for these patients in our hospitals. The apparatus required, or form of treatment, may be applied in a hospital, but it does not require hospitalization for the subsequent care and they can be cared for adequately in their homes.

A group of 70 cases—28 intracapsular, with 89.2 per cent recovering with union and good function, and of the extracapsular 94.9 per cent had similar results—compared with the report of the British Committee on Fractures, in which only 23 per cent of those examined were classed as having good results, seems convincing.

FRACTURE OF THE SHAFT OF THE FEMUR.—Eliason¹⁰⁸ has analyzed a group of 115 cases of fracture of the shaft of the femur occurring at the hospital of the University of Pennsylvania. His summary should be very valuable:

1. In patients, under eight years of age, the Bryant, or perpendicular, treatment gave the best results; 85 per cent excellent, and 100 per cent good.
2. In the 88 cases, ten years of age or older, the primary reduction and dressing were not satisfactory in a single case.
3. A small group of 8 cases, which were later set in plaster under traction, all showed shortening or non-union.
4. In a group of 20 cases dressed in the flexed position, with weight traction, 25 per cent gave good results, with no deformity.
5. Internal fixation failed to hold the fracture in 21 of 54 cases. The causes of this failure, he believes, were in the greater number of cases due to the position in which the limb was splinted, 20 being dressed in the flat position.
6. Non-union, or better, delayed union, for longer than seven weeks was more often due to faulty fixation of the fracture and occurred in

¹⁰⁸ Annals of Surgery, August, 1921, No. 2, 74, 206.

22.2 per cent of the operative, 0.86 per cent of the non-operative, and in 10 plus per cent of the entire series.

7. Operation gave 81.6 per cent good results; non-operative methods gave 73.9 per cent. It must be remembered, however, that this last group of non-operative included the 24 children who had 100 per cent good results, which really distorts this figure.

8. Of the operative procedures, the use of plates and screws with wound drainage and the limb dressed in plaster, in flexed position, with postoperative traction maintained, gave 90 per cent perfect results, plus 10 per cent good. All other operative methods gave but $33\frac{1}{3}$ per cent perfect results, plus $33\frac{1}{3}$ per cent good results.

Plaster casings are not a good permanent dressing unless traction is used and the case kept under close observation until union is firm and special care being taken, as shrinkage of the limb occurs, to apply a new cast. This latter precaution is very important, for if there is too much room in the cast at the site of the fracture, each time the patient raises himself in bed the psoas muscle acting against the fracture will loosen the internal fixation.

Treatment of Fractures of the Femur. Speed¹⁰⁹ has collected and analyzed the reports of 526 cases of fracture of the femur observed at the Cook's County Hospital in Chicago. Three hundred and twenty-eight were males, 198 females. The right and left femurs were affected in about equal proportion. The mortality was 11 per cent, one-third of which was due to pneumonia. The patient with a fractured femur should be treated in a hospital, and the fracture should be examined with the *x-ray* at the earliest possible moment, reduced and splinted at once, so that extensive muscle infiltration and contraction will be prevented. He also emphasizes that because of no accepted American standard of results following fractures of the femur, there is no American standard of treatment. That they are usually cared for by the first physician who sees them instead of a specialist is also probably one of the explanations of the high percentage of permanent disability following this fracture. He approved thoroughly of the abduction treatment of Whitman, makes a plea for the equipping of every hospital with portable *x-ray* outfits so that it will be possible to check the results of the treatment during all stages. He makes a very proper criticism that too many operations have been performed on fractured femurs by inexperienced operators without proper indications. Though it may be generally known, we do not feel it has been sufficiently emphasized, in recent literature at least, that operation upon the femur is one of the most shocking procedures in surgery. Time and again it has been brought to our attention, and we feel that this factor should always be taken into consideration when the operative treatment of a fracture of the femur is being discussed. Speed also emphasizes the necessity for, and the usual neglect of, massage and electric stimulation of the muscles during bone repair and the period of after-treatment. His experience confirms that of Jones, Bowlby and Blake that many patients,

¹⁰⁹ Archives of Surgery, 1921, 2, 45.

and we would say most patients, are permitted to bear weight on a soft callus long before it is strong enough. Walking caliper splints are rarely used at the present time. It has been our practice to fit every patient with a fractured femur with a walking caliper splint weeks before he leaves the hospital, and to encourage the wearing of these braces for at least a year after the receipt of the injury.

FRACTURE OF THE FEMORAL DIAPHYSIS IN CHILDREN UNDER TWELVE YEARS OF AGE.¹¹⁰ Every fractured femur in a child should be given immediate treatment; except for the treatment of shock or other important injuries than the fracture, little can be gained by the delay and much may be lost. A spreading hemorrhagic and inflammatory infiltration of the muscles and tissues surrounding the fracture progresses rapidly. The infiltration increases the shortening already caused



FIG. 30.—Battery of fracture beds. Note the simple overhead frame securely attached to the bed, in no way interfering with the floor. All weights are at the head, out of the way of passers by. The child can sit up in bed and have much freedom while the leg is in constant suspension traction in a Thomas splint. (Speed.)

by the trauma causing the fracture. Every hour of delay diminishes the ease and possibility of perfect reduction by mechanical traction on a fracture table. Long-continued and sufficiently powerful continuous tractions may accomplish an end-to-end coaptation, but, the sooner it is applied, the greater the hope of satisfactory alignment. To facilitate realignment of the fragments, traction must be used in such a manner as to bring the easily moved and controlled distal fragments into line with the proximal fragments. Speed emphasizes that there is no one apparatus which is applicable to all diaphyseal fractures, each patient requiring individual study. It has been his experience that plaster-of-Paris casings, even when applied on the fracture table, will not satisfactorily retain the fragments in position; the deformity existing

¹¹⁰ Surgery, Gynecology and Obstetrics, June, 1921, p. 527.

at the time of fracture tends to reproduce itself. A good result observed in a plaster cast today may be a poor result when studied a week hence. The powerful thigh muscles retain their contractile power while the limb is within the cast. If the fragments can be interlocked or impacted, the end-to-end displacement may not occur, but axial bowing or angulation may take place. When fractures of the femur have been operated upon and fixed by internal splints, these secondary displacements are not so likely to occur, but, even with Lane plates attached to the femur, when improperly supported by additional external splints, the fragments may be bent by muscle action within the cast.

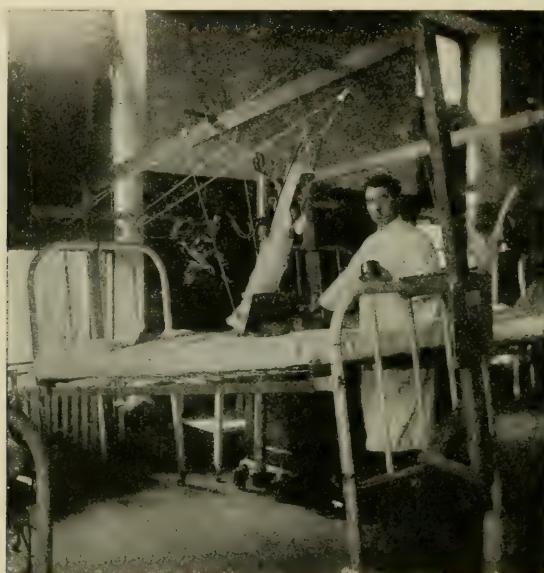


FIG. 31.—Roentgenologist making a bedside exposure. Plates taken in two planes are required. The portable *x-ray* is the most important factor in controlling the angle of the splint, the amount of weight used for traction, and the correction necessary for the best results. (Speed.)

Speed advocates the routine use of a Balkan frame and suspension splint traction for fractures of the femoral shaft in children over four or five years of age. He enumerates its advantages as follows:

1. Constant and steady efficient traction in the axis required against contracting muscles.
2. No pain if the skin is unbroken and a traction weight proportionate to the child's body is used.
3. The patient has bedroom in which to amuse himself, to use the bed-pan and permit nursing attention.
4. A maximum length and good axial alignment can be obtained by this method if care is given to the details.
5. Splints permitting knee movements during traction can be used. Most children do not need them. They recover quickly from any knee stiffness acquired during the four weeks of traction.

6. The usual result is much better than any other non-operative treatment.

When the children are younger than four years, the patients total weight compared with the limb's weight is insufficient to insure a satisfactory result by suspension traction in a Hodgen or Thomas splint. The patients are not tractable and will twist about too much. Any operation, even the insertion of a caliper, is contraindicated under three years. At this age he recommends the overhead suspension of both legs after the manner of Bryant. Should the skin on the leg of an older child break down and become infected from the adhesive or glue traction (Speed prefers Sinclair glue), or if the fracture be in the lower third of the shaft and a little extra force is needed to pull the flexed distal fragment into line, calipers or nail extension is needed. The caliper or nail should not be left in over three weeks, and care should be taken to guard against infection. Speed prefers the nail extension. He very properly emphasizes that all splints, dressings, extensions, ropes, pulleys and weights must be inspected and adjusted, if necessary, at least twice daily. And, further, that the portable *x-ray* apparatus must be used for the control of the position gained by traction. Roentgenograms should be made within forty-eight hours after the leg has been established in extension and suspension, and not wait until the callus is so firm that it is impossible to correct a faulty position.

THE RECONSTRUCTIVE OPERATION FOR UNUNITED FRACTURE OF THE NECK OF THE FEMUR. Whitman¹¹¹ states that ununited fractures of the neck of the femur present a disability which is much greater than that of any other bone. In most instances crutches are required for locomotion. There is usually discomfort on changing from rest to activity, and often severe pain at night, apparently caused by friction or interlocking of the fragments. Occasionally, the capsule, or the fibrous union, or the interlocked fragments, may be sufficiently resistant to assure stability, but there is usually a tendency to further displacement, with consequent increase of functional disability (Fig. 32).

As a rule, the discomfort is greatest in the cases in which the fragments are fairly well apposed, thus offering an opportunity for friction (Fig. 33). The operative treatment offers the only prospect of definite relief, and heretofore operative procedures have been practically limited to attempts to secure direct union of the fragments. We have previously reviewed this operation, as described by Henderson. The essentials of success are that the neck be sufficiently long to permit of a sufficient range of abduction, and that, on the removal of the fibrous tissue, the surface of each fragment bleeds freely. The fragments, accurately apposed by abducting the limbs to the proper degree and fixed by a bone peg, will unite with a fair degree of certainty, which Whitman says indicates that if the abduction method had been applied originally the secondary operation would have been unnecessary.

In a large proportion of cases, however, such operative procedures are impractical because of the long interval after the injury —when the

¹¹¹ Surgery, Gynecology and Obstetrics, June, 1921, p. 479.

neck fragment has practically disappeared and when the circulation has been greatly reduced by the atrophy of disuse (Fig. 34). Further-

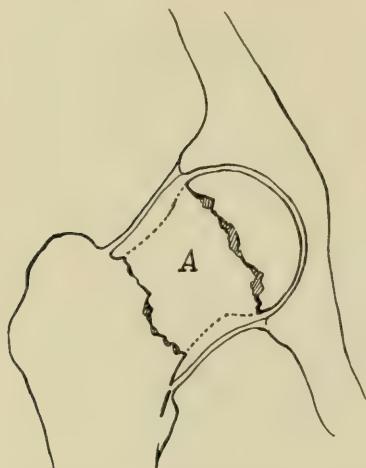


FIG. 32.—*a*, The area of the neck that is usually "absorbed" in ununited fractures of long standing. (Whitman.)

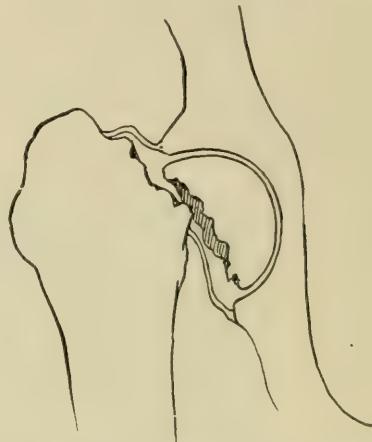


FIG. 33.—The relation of the fragments in the ordinary type of ununited fracture. The shaft of the femur is displaced upward and adducted. (Whitman.)

more, the majority of patients are elderly subjects and in them the outcome is very uncertain, and the functional result imperfect because



FIG. 34.—The fragments are apposed for direct repair, illustrating contact of the trochanter with the rim of the acetabulum, which checks abduction of the limb and causes functional disability, even when union is attained. (Whitman.)

of the degenerative changes involving the components of the joint. Henderson, in a group of 120 cases at the Mayo Clinic, considered it

advisable to operate on only 26 of them, and in these the functional result was satisfactory in 10, or but 8 per cent. The procedure suggested by Whitman consists in making an incision shaped like half of a U beginning about one inch behind the anterior-superior spine and extending downward and backward, crossing the femur at a point three inches below the apex of the trochanter (Fig. 35). The interval between the tensor fascia and the gluteus medius muscles is exposed; the capsule is opened and the head of the femur is removed (Fig. 36). The anterior margin of the gluteus minimus is followed to its insertion and at this point, with a wide, thin chisel, the base of the trochanter is cut through

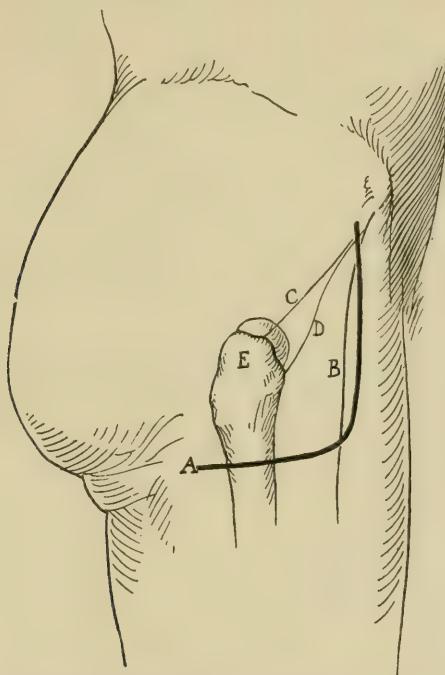


FIG. 35.—*a*, Line of incision; *b*, the tensor fascia femoris; *c*, the anterior margin of the gluteus medius; *d*, the anterior margin of the gluteus minimus; *e*, the trochanter. (Whitman.)

in an oblique direction corresponding to the angle of the neck, including all of its muscular attachments and often a part of the capsule. This flap of bone and muscle is turned upward, and the upper extremity of the femur, having been somewhat remodelled by cutting away the projections of the posterior intertrochanteric line, is free from any resisting tissues, and thrust completely within the acetabulum at an angle of about twenty-five degrees of abduction (Figs. 37 and 38). The trochanter is then drawn downward as far as its attachments will permit, and, after removing sufficient cortex from the new position of the trochanter upon the lateral aspect of the femur, the two bare surfaces are apposed, the axis of the trochanter being thereby changed from a

direction upward and inward to outward and upward. It is secured in this position by a drill, a peg or a suture passed through the bones. After closing the wound in layers, a long plaster spica dressing is applied, fixing the limb in extension and abduction. This may be replaced in

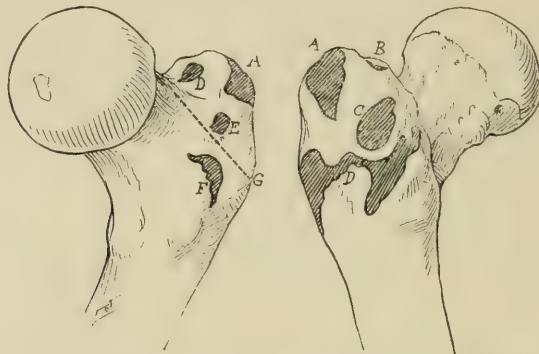


FIG. 36.—The muscular attachments of the trochanter. At left, the posterior and internal surface of the trochanter. *a*, Gluteus medius; *d*, obturator internus pyriformis, and gemelli; *e*, obturator externus; *f*, quadratus femoris; *g*, line of section. At right, the anterior and external surface of the trochanter. *a*, gluteus medius; *b*, pyriformis-obturator internus and gemelli; *c*, gluteus minimus; *d*, vastus. (Whitman.)

about four weeks by a short spica. The patient is encouraged to bear weight and thus hasten the reconstruction of the articulation by a functional adaptation of the limb to the new conditions. When the weight may be borne without discomfort, the support is removed and muscular control is re-established by systematic exercise.

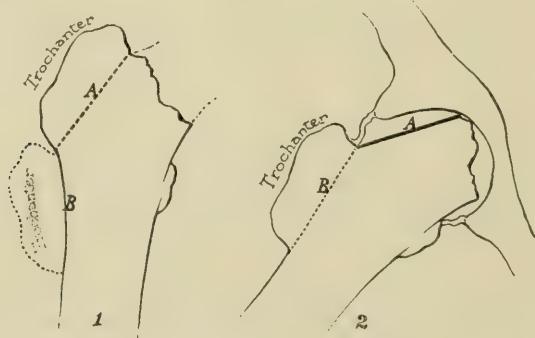


FIG. 37

FIG. 38

Figs. 37 and 38.—The reconstruction operation. Fig. 37 (at left), the line of section of the trochanter and the point on the shaft to which it is to be transferred. Fig. 38, the reconstructed neck. (Whitman.)

Treatment of Diaphyseal Leg Fractures by Encircling the Tibia with Bands. Robert¹¹² writes approvingly of osteosynthesis for oblique

¹¹² Rev. Med. de la Suisse Rom., 1921, 40, 782.

fractures of the tibia, particularly in the region of the middle and lower third, where apposition cannot be obtained. He prefers to do the operation between the fifth and the seventh day following the injury. Perfect reduction usually can be obtained and its advantages over the compromising results that are usually accepted speak for themselves. Personally, we have had very gratifying success. Robert speaks of the only inconvenience being in the occasional necessity of having to remove the metal strip because of irritation. In our experience this has been necessary in but 1 case, a fracture of the humerus, and it was done in this case because the artificial forearm which was to be fitted would directly bear upon the band.

A Method of Applying Extension with Plaster-case Fixation in Fractures of the Leg. T. Turner Thomas¹¹³ proposes a method of applying traction by encasing the foot in a plaster cast. This has been attempted in the past and it has been found that the foot will not tolerate the traction necessary to overcome the deformity. Thomas suggests that the portion of the case immediately overlying the points of greatest pressure be removed and the remaining upper surface of the foot, heavily padded with cotton, receives the extending force.

Fracture of the Os Calcis. Two per cent of all fractures involve the os calcis and the unsatisfactory results obtained by the usual method of treatment of fractures of this bone warrant the scrutiny of any new suggestion.

Strauss¹¹⁴ described the mechanism of the fracture as occurring in a large majority of cases after a fall from a height, the patient landing on his feet, on some hard substance, such as the ground. When the foot strikes the ground, the os calcis is suddenly held rigid while the weight of the body is transmitted to the astragalus, which acts as a wedge. The tuberosity of the os calcis is forced upward by the impact. As a result, the line of fracture usually extends downward from the concave articular facet beneath the wedge-shaped articular surface of the astragalus. Not only is the posterior fragment of the os calcis driven upward by the impact at the time of the fracture, but it is held in this position by the constant tone of the Achilles tendon. The latter presents the chief obstacle to reduction. The longitudinal arch of the foot gives way at the time of fracture, with a resulting traumatic flat foot.

The method suggested by Strauss is as follows: Under general anesthesia with the patient on a table so that traction can be made (the Hawley or Albee) subcutaneous tenotomy of the Achilles tendon is performed. A Steinmann pin is then inserted from the medial to the lateral surface of the heel in front of the Achilles tendon and over the upper surface of the body of the os calcis. The pin extends an equal distance beyond each side of the foot. The wounds in the skin are covered with sterile gauze, which is bandaged in place to prevent soiling during the application of the plaster cast. The Steinmann caliper is now applied to the pin and downward traction is effected by

¹¹³ Surgical Clinics of North America, February, 1921, 1, 207.

¹¹⁴ Journal of the American Medical Association, July 16, 1921, No. 3, 37, 176.

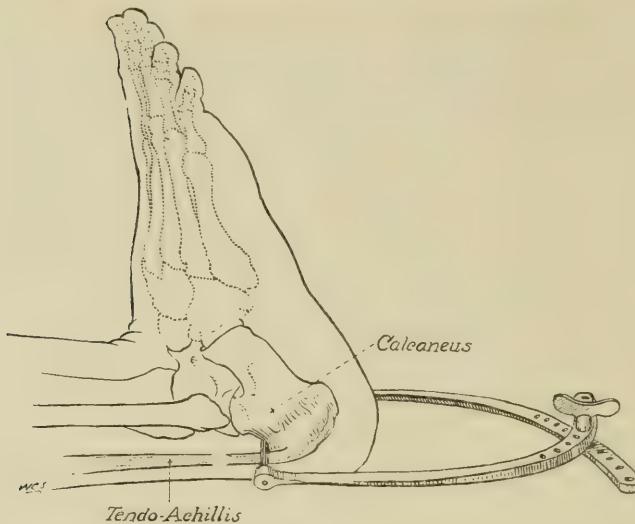


FIG. 39.—Diagram to show point of insertion of Steinmann pin and method of application of calipers. The Achilles tendon is divided before the Steinmann pin is inserted. (Strauss.)

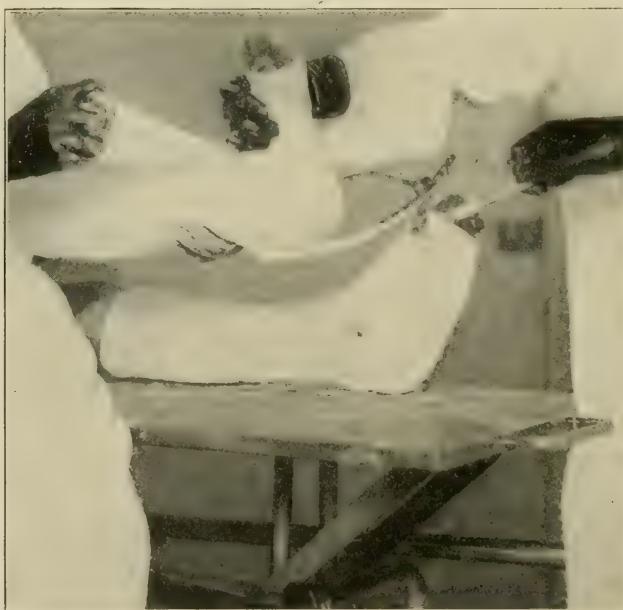


FIG. 40.—Manner of maintaining downward traction of posterior fragment while the cast is being applied. Ordinarily the operator has two assistants, one of whom maintains the downward traction on the posterior fragment, as shown, while the second supports the leg, the operator applying the plaster bandage. After the plaster bandage has been applied, the operator uses the orthopaedic block to maintain upward pressure under the instep and make any necessary correction in the position of the foot. (Strauss.)

an assistant who stands beyond the end of the table. Any impaction that may exist is broken up and the posterior fragment is drawn strongly downward, while the anterior portion of the foot is forced downward and inverted counterpressure upward is made against the anterior fragment of the os calcis and the arch of the foot by means of an orthopaedic block. The block also aids in the correction of the median displacement of the astragalus. The foot is held in the corrected position, and, after applying padding from the knee to the toes, a plaster-of-Paris cast is applied, reaching from the tuberosity of the tibia to the heads of the metatarsal bone. While waiting for the cast to set, continuous traction downward is maintained. This downward traction is the essential of the method, and, while it is being maintained, upward pressure on the anterior fragment and the instep is exerted by use of the orthopaedic block, care being taken to hold the astragalus in its proper position. After the cast is set, Strauss removes the two halves of the Steinmann pin, and, as they are removed from within outward by unscrewing them, there is no danger of infection. It would seem to us safer to allow the Steinmann pin to remain in place until after an *x-ray* examination has demonstrated a satisfactory reduction, then if the first attempt is unsatisfactory the first cast could be removed and subsequent ones applied without reintroducing the pin.

A System of Joint Measurement.—The ambiguous way in which the limits of motion and angles of deformity in the joints are expressed in literature has suggested to Clark¹¹⁵ an attempt to standardize such measurements. He bases this standardization upon the arc of the angle included between the bones on either side of the joint, complete extension being 180 degrees. Any movement beyond 180 degrees is recorded as hyperextension and regarded as analogous to flexion, but in the opposite direction to normal. Such a movement may be expressed, for example, as hyperextension to 170 degrees. In the system the number does not represent the number of degrees through which the part has moved, but the angle on the scale from 0 to 180 where it stops. In other words, it indicates the limits of motion and not the amount. He speaks of flexion as a movement in the antero-posterior plane in the direction of its greatest range, beginning at 180 and approaching 0. Abduction starts at 180 and implies a movement away from the medium line of the body in an arch approaching 0. The angle measured is that included externally between the member moved and the cephalic part of a line passing through the joint and parallel with the medium line of the body. Adduction is a movement from 180 degrees toward the medium line, and the angle measured is that included internally between the member moved and the cephalic part of a line passing through the joint and parallel with the medium line of the body. Rotation is measured on the anterior half of a circle whose center coincides with the axis of rotation and whose plane is perpendicular to that of the axis, with the scale running from 0 on the inner side to 180 degrees on the outer. Measurement is made at the distal end of the bone

¹¹⁵ Journal of Orthopaedic Surgery 1920, n. s., 2, 687.

rotated, at the femoral condyle in the case of the thigh. The single exception is in the radius because the axis of rotation passes through the lower end of the ulnar. Here the indicating line is the external projection of the lateral line of the radio-ulnar styloids, thus complete supination would read 180 degrees and complete pronation 145 degrees.

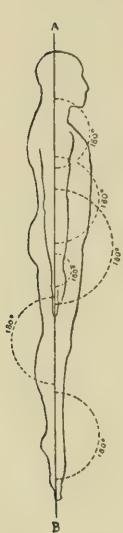


FIG. 41

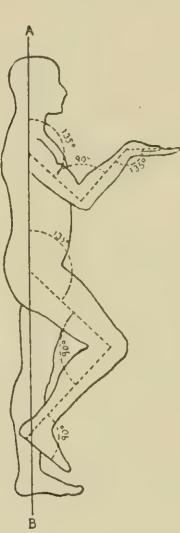


FIG. 42

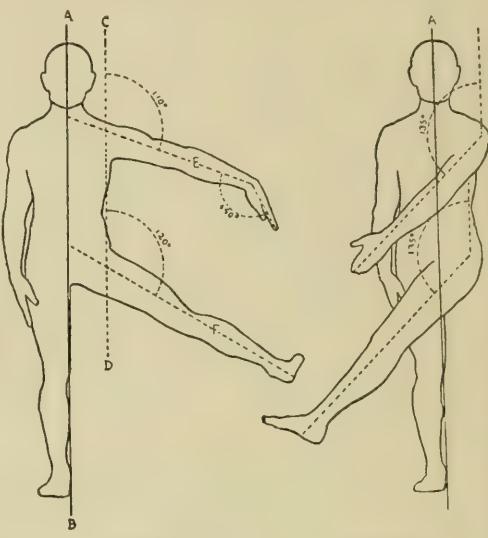


FIG. 43

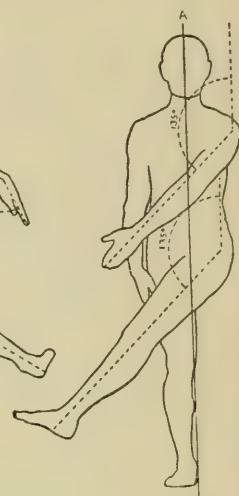


FIG. 44

FIG. 41.—Neutral position, complete extension of all joints.

FIG. 42.—Flexion, shoulder to 135 degrees, elbow to 90 degrees, hip to 135 degrees, knee to 90 degrees, ankle (dorsal flexion) to 90 degrees, hyperextension of wrist to 135 degrees.

FIG. 43.—Abduction, shoulder to 110 degrees, hip to 120 degrees, flexion of wrist to 140 degrees.

FIG. 44.—Adduction, shoulder to 135 degrees, hip to 135 degrees.

Active Mobilization in the Treatment of Joint Injuries.—Willem¹¹⁶ in a communication read by title before the American Surgical Association, writes that from a perusal of many published observations of other surgeons, his method is almost never correctly applied. It is not sufficient to be content with partial results, even though they greatly exceed anything obtained by the old classical methods of treatment. In purulent arthritis, for example, it is not sufficient to conserve mobility, but just as necessary to prevent muscular atrophy, and, when muscular atrophy accompanies the end-result, it is because the movements have been commenced too late, they have been too infrequent or have not been continued long enough. The authors frequently indicate that these patients with purulent arthritis began active movements early, but were obliged to discontinue them, not having sufficient power to execute them at a given moment. To Willem this indicates a retention of pus which is the result of insufficient mobilization. Instead of stopping the movements, either the incision should be

¹¹⁶ Annals of Surgery, October, 1921, No. 4, 72, 425.

enlarged or the movements should be made more complete. It is natural that the patient should at first try to avoid the obligations of moving the joint, which he regards as a painful task. The constant attention of a nurse familiar with the method is often a necessary adjunct for the successful carrying out of this treatment. He is a little more radical than in his earlier publications about active mobilization in wounds of joints complicated by fracture. He now advises that it be employed in fractures of all joints. If the articular wound is complicated by infection, he feels that mobilization is still more strongly indicated, as it alone can give drainage. He feels that active mobilization knows no contraindications by reason of the extent of bony lesions, or destruction of the ligaments. He urges that surgeons do not abandon it at the first difficulty, but, on the contrary, pursue it to the end, with the firm conviction that the functional result will be the more brilliant in the same proportion as the efforts to obtain it have been more energetic and tenacious.

Cohen¹¹⁷ reports his experience with 16 cases, in all of which there was early and complete return of normal function.

Eising¹¹⁸ reports favorably upon the same method.

Gonorrhreal Arthritis.—The conception that a focus of infection may be the cause of so-called rheumatic manifestations have become well established; the teeth, the tonsils and the sinuses of the head attracting the most attention at sites of such foci. One must not, however, fail to include in the search other sites. The genito-urinary tract, the prostate and seminal vesicles in Cunningham's¹¹⁹ opinion rank in frequency of occurrence in the production of arthritis with the teeth and tonsils.

Birth Injury of the Right Shoulder.—Ashhurst¹²⁰ reports a paralysis in a girl, aged ten years, of the Dejerine-Klumpke type, the paralysis being confined to the hand and forearm, indicating that the disabling lesions were in the lower roots of the brachial plexus. Upon exposing the brachial plexus by an incision 8 cm. long above and parallel to the left clavicle, definite scar tissue was found. After clearing away the scar tissue as far as possible, the nerve to the subclavius muscle was divided and an effort made with the faradic current to stimulate the fifth and sixth nerves to determine whether motion could be transmitted to the hand, but no motion extended beyond the elbow. The same negative result followed stimulation of the seventh and eighth roots. A pedunculated flap of fat from the region of the trapezius was passed beneath the roots of the fifth and sixth, and over the seventh and eighth cervical roots, in order to prevent, if possible, reformation of dense scar tissue.

Restoration of Shoulder Function in Cases of Loss of Head and Upper Portion of Humerus.—Albee¹²² says of all surgical conditions perhaps none present a picture of greater helplessness than an arm dangling from

¹¹⁷ New York Medical Journal, May 18, 1921, **113**, 730. ¹¹⁸ Ibid., **113**, 734.

¹¹⁹ Surgery, Gynecology and Obstetrics, June, 1921, p. 501.

¹²⁰ Surg. Clin. N. A., February, 1921, **1**, 127.

¹²¹ Surgery, Gynecology and Obstetrics, January, 1921, No. 1, **32**.

a shoulder in which the upper portion of the humerus is missing. In the base hospitals, in 1915, this was a frequent condition, as many of the English surgeons were practising and teaching the complete resection of infected fractured bony tissue. It was the practice to excise through healthy bone an inch or more beyond the lesion, removing bone and periosteum. The end-result was bad enough when portions of the shaft only were removed, but, when the removal included an articulating end, the problem seemed hopeless. There are still a num-



FIG. 45.—Case 1. Showing a patient in the dorsal position on the author's fracture-orthopaedic table. In fractures of the upper portion of the humerus, with or without loss of bone substance, position of the extremity during operation and the subsequent application of the plaster cast is most important. (Albee.)

ber of such cases with this disability, but there are also in civil life many other causes of the loss of the head and upper part of the shaft of the humerus. Destructive osteomyelitis, compound fracture, new-growth, such as sarcoma, and occasionally congenital absence of the upper end of the humerus has been observed. This condition usually presents an arm which is merely a cumbersome appendage, which from a practical standpoint is useless. Some success was obtained by dressing the arm in such a position that the proximal end of the humerus was forced in contact with the glenoid cavity to form an angle of 45

degrees with its normal position. If ankylosis took place, a fairly serviceable motion was obtained of the upper extremity by movement of the scapula. Of course, there is always a definite shortening and the function could in no way be called normal. Albee has employed the autogenous bone grafts to replace the lost bone, and in many instances restoring the joint function. He classifies cases of loss of head and upper portion of the humerus according to their surgical treatment into two groups. This classification is based upon the condition of the shoulder musculature. In the first group the muscles have not been injured to such an extent as to make impossible a mov-



FIG. 46.—Sarcoma upper end of humerus. (Albee.)

able, functioning, reconstructed shoulder-joint. In these cases he restores the loss of the head of the humerus by transplanting to it the upper portion of the patient's fibula. In the second group are those cases in which the muscles are so damaged that it is impossible to obtain restoration of function, and joint motion at the shoulder is impossible. The object in treatment of cases of this type consists in securing a posture of the humerus and upper extremity in relation to the scapula, by an arthrodesis of the shoulder-joint, which brings about a compensatory function by the scapulo-thoracic motion to replace the shoulder-joint motion which has been lost.

The essentials of this posture are as follows: With the scapula in

a neutral position, namely, flat against the chest wall, the humerus is elevated anteriorly at right-angles to the trunk, and in a degree of rotation which brings the hand in front of the face, as is shown in Fig. 45. The humerus is arthrodesed to the scapula by a truss work of tibial grafts. With the arm immobilized by a plaster-of-Paris shoulder spica in this position in relation to the scapula, the powerful scapulo-thoracic muscles are later able to control it with an unexpected degree of efficiency, and the hand may be brought with great readiness to the necktie, mouth or hair, functions impossible to perform when there is a lack of control of the upper extremity of the shoulder.

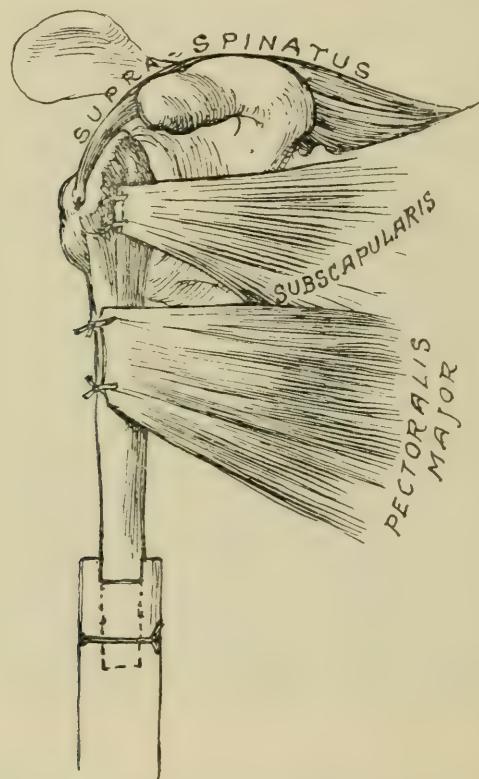


FIG. 47.—Case 1. Each muscle was fastened upon the fibula transplant in the place of its proper insertion by means of kangaroo-tendon which was passed through drill-holes made in the bone. (Albee.)

The technic in illustrative cases: Albee reports as an example of Group I, an extensive osteosarcoma of the upper end of the humerus, which necessitated operative removal of more than four inches of the humerus, including the head (Fig. 46). In this case the shoulder musculature was practically uninjured, and it was possible, after replacement of the excised bone with a fibula transplant, to reattach the shoulder muscles in their proper relationship (Figs. 47 and 48).

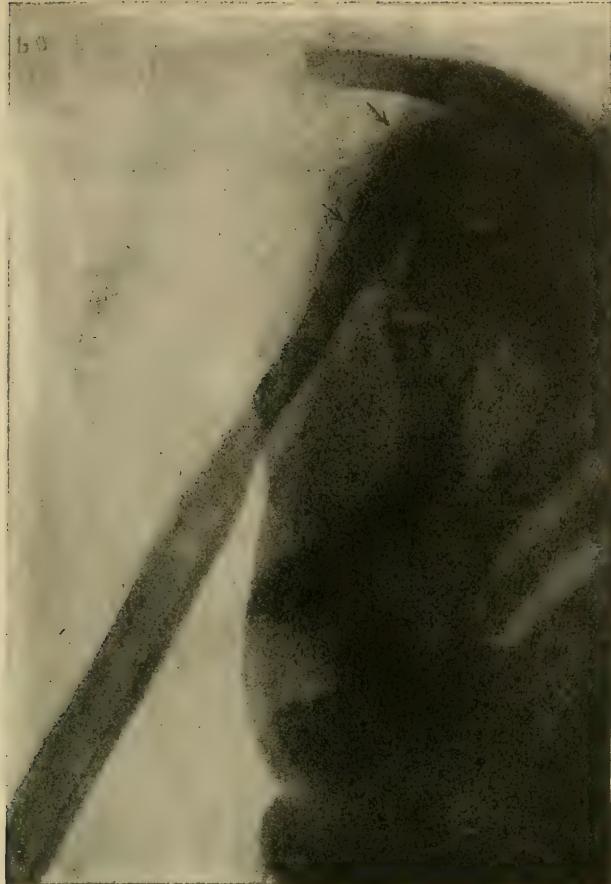


FIG. 48.—Case 1. Roentgenogram taken four months after bone-graft operation. Note complete bony union of lower end of graft with the humeral shaft and the tendency to cortical fusion. The arrows indicate drill-holes in graft through which muscles were attached by means of fine kangaroo tendon at proper place of insertion. (Albee.)



FIG. 49.—Case 3. An American soldier wounded in France by fragments of a high explosive shell which destroyed the greater portion of the upper third of the left humerus, including the head. Note the sagging at shoulder due to loss of substance. The patient was powerless to raise the arm, owing to its flail condition, and he maintained the position shown in the photograph by firmly grasping his belt, after the arm had been "proped up" by an assistant. (Albee.)

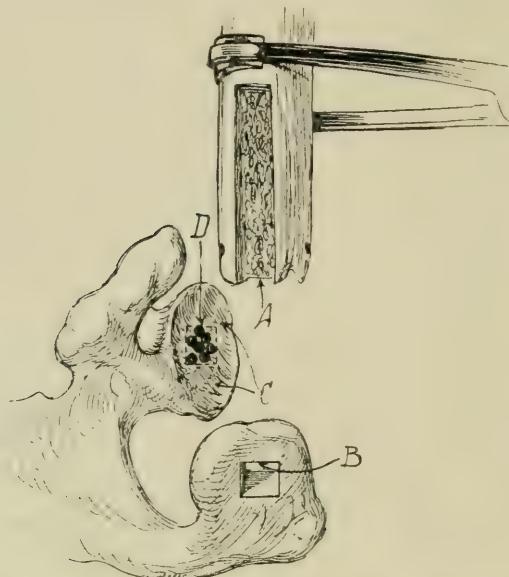


FIG. 50.—Case 4. Diagrammatic drawing (superior view) showing groove *a*, in humeral fragment; mortise *b*, in acromion process; glenoid cavity denuded of cartilage, *c*; and holes drilled at *d*, preparatory to making the mortise in glenoid cavity. (Albee, Orthopedic and Reconstruction Surgery.)

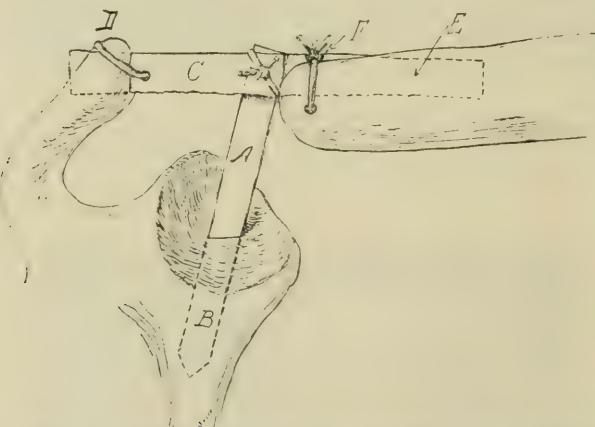


FIG. 51.—Case 4. Diagrammatic drawing (anterior view) showing truss-work of tibial grafts in place and fixed with kangaroo-tendon ligatures. Graft *c* is inlaid into the groove prepared in the shaft of the humeral fragment, at *e*, and mortised in the shaft of the humeral fragment, at *e*, and mortised into the acromion process at *d*. This graft is slightly dented by the motor drill at *f*, and kangaroo-tendon passed through a drill-hole at end of the humeral fragment is fastened at this point in order to hold the graft more securely and prevent possible slipping. A second kangaroo-tendon ligature is made at *d*, passing through a drill-hole in the graft and over the tip of the acromion process. Graft *a*, cut with one end wedge-shaped, is mortised into the glenoid body of the scapula at *b*, and attached by kangaroo-tendon to graft *c* at the point where the latter graft meets the end of the humeral fragment. (Albee, Orthopedic and Reconstruction Surgery.)

Of the type he speaks of as Group II, he reports an American soldier wounded by a high explosive which destroyed the greater portion of the upper third of the left humerus, including the head (Fig. 49). This was the deformity seen so frequently in 1915 and the early part of 1916, resulting from the practice of radical excision for compound fractures. The truss work of tibial transplants is shown in Figs. 50 and 51, and the position for the application of the cast and operation shown in Fig. 52.



FIG. 52.—Case 4. During the plastic operation in this case, in which a truss-work of tibial grafts arthrodesed the humerus to the scapula, the arm was held in the posture shown in the photograph, and the same position was maintained in the application of the plaster-of-Paris shoulder spica.

Albee feels that these plastic procedures entail a thorough understanding of the mechanics of the arm and shoulder and a technic based upon the physiology of tissue growth and healthy metabolism. He lays stress upon the following points:

1. *Preoperative Treatment.* In infected fractures, no plastic work of any kind should be considered until the wound has been completely healed and there have been no clinical signs of infection for at least two months. The presence of latent infection can often be demonstrated by daily treatments of deep massage and rough manipulation

of the part one or two weeks prior to the operation. This was referred to in our review of 1920, in an article by De Forrest Willard and is the general experience of military surgeons. In those cases which have showed persistent infection over a long period of time, the prevention of subsequent recrudescence may be still further assured by the careful excision of all scar tissue. The object of removing scar tissue is really twofold: (1) To avoid surrounding the graft with unfavorable anemic tissues; and (2) to obviate any possibility of infection following the osteoplastic operation.

2. *Posture of the Arm.* In the treatment of fractures of the upper humerus, with or without loss of bone, the position of the extremity is a most important feature. Fig. 53 illustrates the usual deformity. Owing to the unopposed action of the supraspinatus and subscapularis muscles, the head of the humerus is pulled out of alignment with the

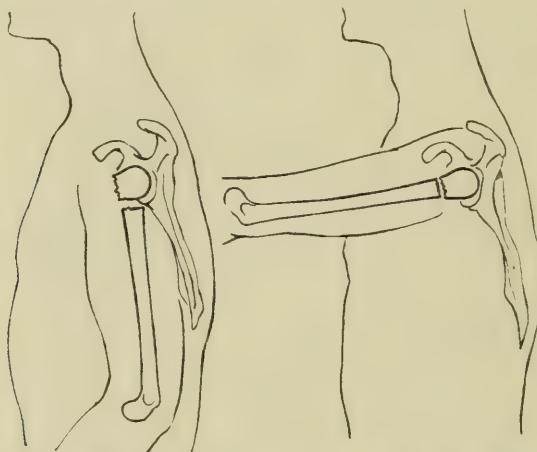


FIG. 53.—Case 2. Diagrammatic drawings to illustrate the position of the humeral fragments: *a*, when the arm is put up in the old, classical posture parallel with the trunk; *b*, when the arm is maintained in the author's anterior, elevated position, at right angles to the trunk. (Albee.)

axis of the long fragment, and is rotated upward and outward so that its fractured surface is directly anteriorly instead of approximating the fracture end of the long and distal fragment. As a result of this rotation of the head, the fractured end of the long fragment is directed against the side of the head of the humerus; if the fracture is intracapsular, the fractured surface lies in contact with hyaline cartilage; if extracapsular, the fractured end comes into contact with the slippery surface of the capsule. Instead of the classical postural treatment of this type of fracture, holding the arm parallel with the trunk, Albee advocates elevating the arm anteriorly at right-angles to the trunk, the long humeral fragment, which may be easily controlled, is thus brought into alignment with the head of the humerus and the fractured ends are approximated. To obtain this position during operation and during the application of the fixation plaster-of-Paris cast, he uses an

attachment with an orthopaedic table which makes this possible (Figs. 2 and 20).

3. *Immobilization.* At the completion of the operation, with the patient's arm suspended in the desired position, a plaster cast is applied from the tip of the fingers up over the forearm, arm, shoulder and across the thorax to the costal margins. A plaster post is inserted between the forearm and the chest portions of the splint to obviate the need for a large amount of plaster over the shoulder. This plaster spica remains undisturbed for a period of ten to twelve weeks. Following its removal, the *x*-rays will determine the condition of the graft, and, should any doubt about its strength exist, a second spica or an aero-plane splint worn as long as the *x*-ray examinations indicate. Great conservatism should be used in the final removal of all supports in these cases for a great amount of right-angle stress is brought to bear upon such grafts.

4. *Vocational Therapy.* Albee agrees with most surgeons that active motion is much more potent in the restoration of function than any form of passive exercise. Curative work shops, such as had been established in the reconstruction hospitals, and which we previously reviewed in detail in December number of PROGRESSIVE MEDICINE, 1919, are the ideal. It is through function and the bearing of stress that bone growth is stimulated and the union of the parts is strengthened.

Habitual or Recurrent Dislocation of the Shoulder.—Henderson¹²² reports 26 patients who have been observed. When one considers the poor bony formation of the shoulder-joint from the viewpoint of mechanics and how rare a dislocation of the shoulder is, the wonderful mechanism and muscle balance that prevents such an occurrence is appreciated.

In recurrent dislocation of the shoulder there is invariably a history of a severe injury at the time of the primary dislocation which has been followed by a normal convalescence, but the second and subsequent dislocations usually are not accompanied by any trauma or severe muscle strain. Unfortunately, there are no statistics which show the percentage of persons who have dislocated their shoulder and become sufferers from habitual dislocations. Henderson advocates that, following the primary dislocation, the arm should be held to the side for three weeks and no abduction permitted for at least five weeks. He admits that some stiffness may result, but this can be overcome by massage and use, and, if necessary, by manipulation under an anesthetic.

This certainly is conservative and from our personal experience would seem hardly warranted. Two weeks has, in our experience, been ample. The movements producing habitual dislocation are abduction and a slightly forward motion, the arm being in the position assumed when a person reaches for something on a shelf slightly above the level of the shoulder.

Following his unsuccessful efforts to produce dislocations with the patient on the operating table anesthetized and thoroughly relaxed, he feels convinced that dislocations are rarely due to any primary fault in the structure of the head of the humerus or the glenoid fossa, but

¹²² Surgery, Gynecology and Obstetrics, July, 1921, p. 1.

they are produced by the actions of certain muscles whereby the head of the bone is thrust against a weakened portion of the capsule. He believes that the factors essential to easy recurrence of a dislocation are: The primary dislocation causes a tear in the anterior-interior portion of the capsule, the weakest and most lax region. This area lacks muscle and tendinous support. When the arm is in the position in which most dislocations occur, namely, abduction above the level of the glenoid fossa and slightly forward, the condition of the muscles and the direction of their pull are as follows: The supraspinatus and infraspinatus have not their normal tension and thus allow the head

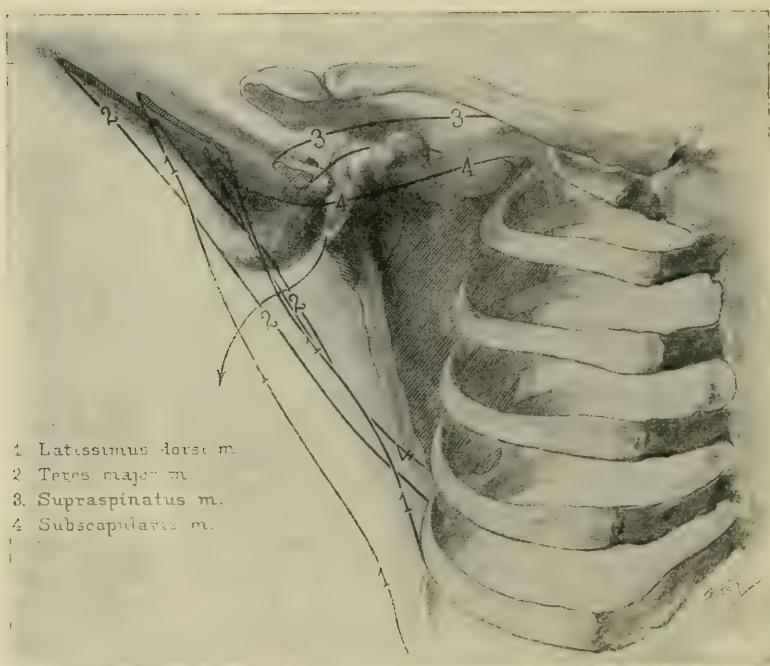


FIG. 54.—Anterior view of shoulder-joint with origin and attachment of muscles concerned in the dislocation. (Henderson.)

of the bone to be a little lower than normal. The teres major, the latissimus dorsi and the pectoralis major tend to pull the head into the glenoid fossa, but they also tend to pull the head downward and forward. The supporting action of the subscapularis is gone because the slightly abnormal low position of the head of the bone places the muscle across the upper half of the head of the bone leaving the lower half unsupported. The head is thus thrust against the weak place in the capsule below the subscapularis, and, as the powerful latissimus dorsi, teres major and pectoralis major contract, the head slips over the edge of the glenoid margin, bulges out the capsule, and glides up, usually to form a sub-coracoid dislocation.

In his group of 23 cases, the average age was twenty-eight years; 20 were males and 3 were females. The dislocations were equally

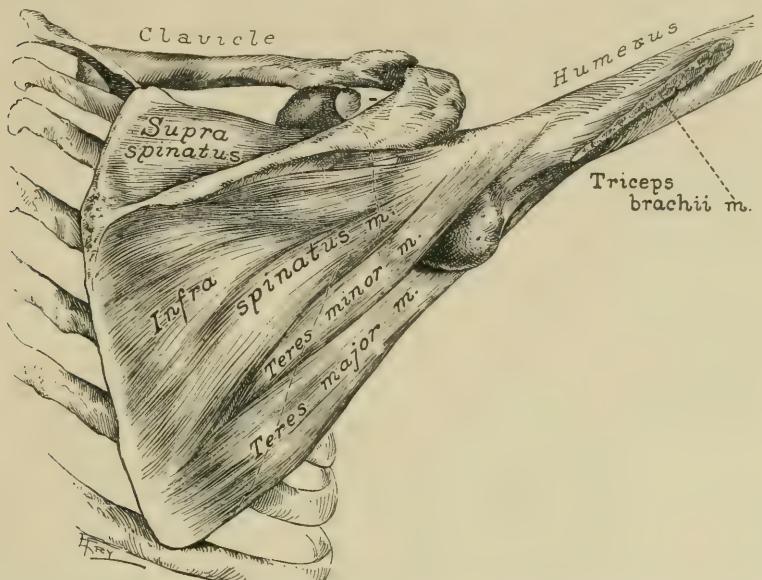


FIG. 55.—Position of muscles on posterior surface of scapula. Capsule of joints is not shown. (Henderson.)

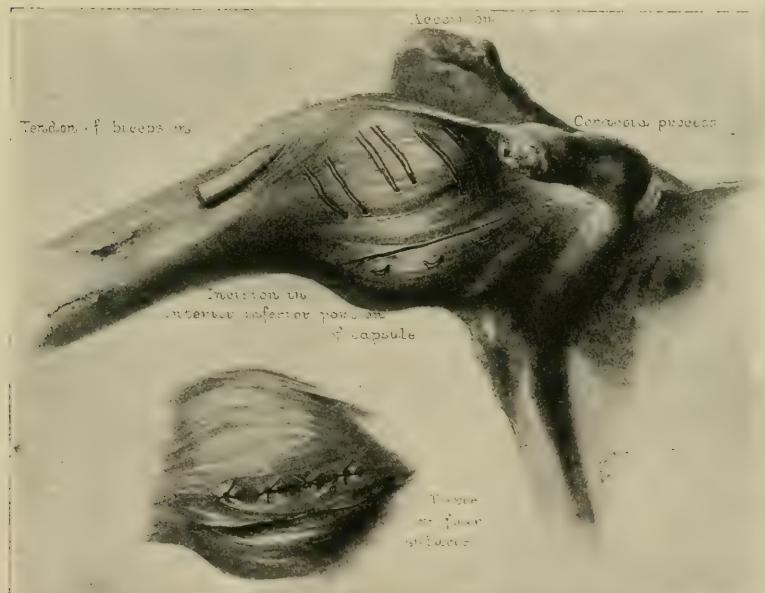


FIG. 56.—Capsulorrhaphy overlapping with four doubled chromic catgut sutures. The principle of the Mayo repair of abdominal hernia is followed in this operation. (Henderson.)

divided as to the right and left side. Trauma was mentioned as the initial cause in all; 19 patients were operated on. Capsulorrhaphy was the type of operation used to prevent the dislocation. The object of the operation was to strengthen the weak point in the capsule which is the anterior-interior portion. His manner of approach is through an incision along the anterior axillary border, carefully avoiding, on deep dissection, the circumflex vessels and nerves. Besides the capsulorrhaphy, which consisted in the overlapping with four doubled chromic catgut sutures, after the principle of the Mayo repair of abdominal hernia, in a certain number of cases he lengthened the pectoralis major muscle, believing that this muscle had something to do with the production of the luxation. In the group he reports 50 per cent of the patients were cured; 31.25 per cent were decidedly improved. Thus, 81.25 per cent were cured or decidedly improved. In 18.75 per cent the operation was a failure.

Thomas¹²³ considers operation to be the best procedure in this condition, and treats it by taking a tuck in the axillary portion of the joint capsule. The capsule of the joint normally prevents the luxation of the humeral head out of its socket, but extreme movements of the shoulder, and particularly abduction and next in frequency external rotation, will, if the force is too great for the resistance of the capsule, tear it, allowing the head to escape from the socket into the axilla forcing the torn margins of the capsule apart. With each repetition of the dislocation these torn capsule margins are separated, and eventually they unite across this constantly recurring gap. Thus, there is added to the normal length of the axillary portion of the capsule a new cicatricial piece so that, when the arm is in the position of extreme abduction, the capsule can no longer prevent the escape of the head from the socket. Perhaps one of the reasons that the condition is so rarely operated upon is because the affected portion is so inaccessible. Thomas employs the posterior axillary route, believing that it gives the freest exposure of the capsule, divides no muscles, usually requires no ligatures for bleeding vessels and gives perfectly dependent drainage so necessary for the first forty-eight hours. The circumflex nerve lies directly in the operative field and care must be taken to avoid it.

Sever¹²⁴ does not agree with Thomas, but considers that recurring dislocation results from the loss of muscular balance of the joint. From an analysis of the muscular action of the shoulder-joint, he is convinced that the pectoralis major, especially the lower portion, is the one muscle which pulls the head of the humerus forward when the arm is held in the position of adduction (?) and elevated. This force of the pectoralis major, combined with a lax subscapularis, must result in an anterior dislocation in this type of case. Complete division of the pectoralis major, with shortening of the subscapular tendon without division, are the two essentials for success. The deltoid and coracobrachialis will hold the head of the humerus in place if given a chance; by removing the pull of the stronger pectoralis major and taking up the slack in

¹²³ Surgery, Gynecology and Obstetrics, April, 1921, **32**, 291.

¹²⁴ Journal of the American Medical Association, April 2, 1921, **76**, 925.

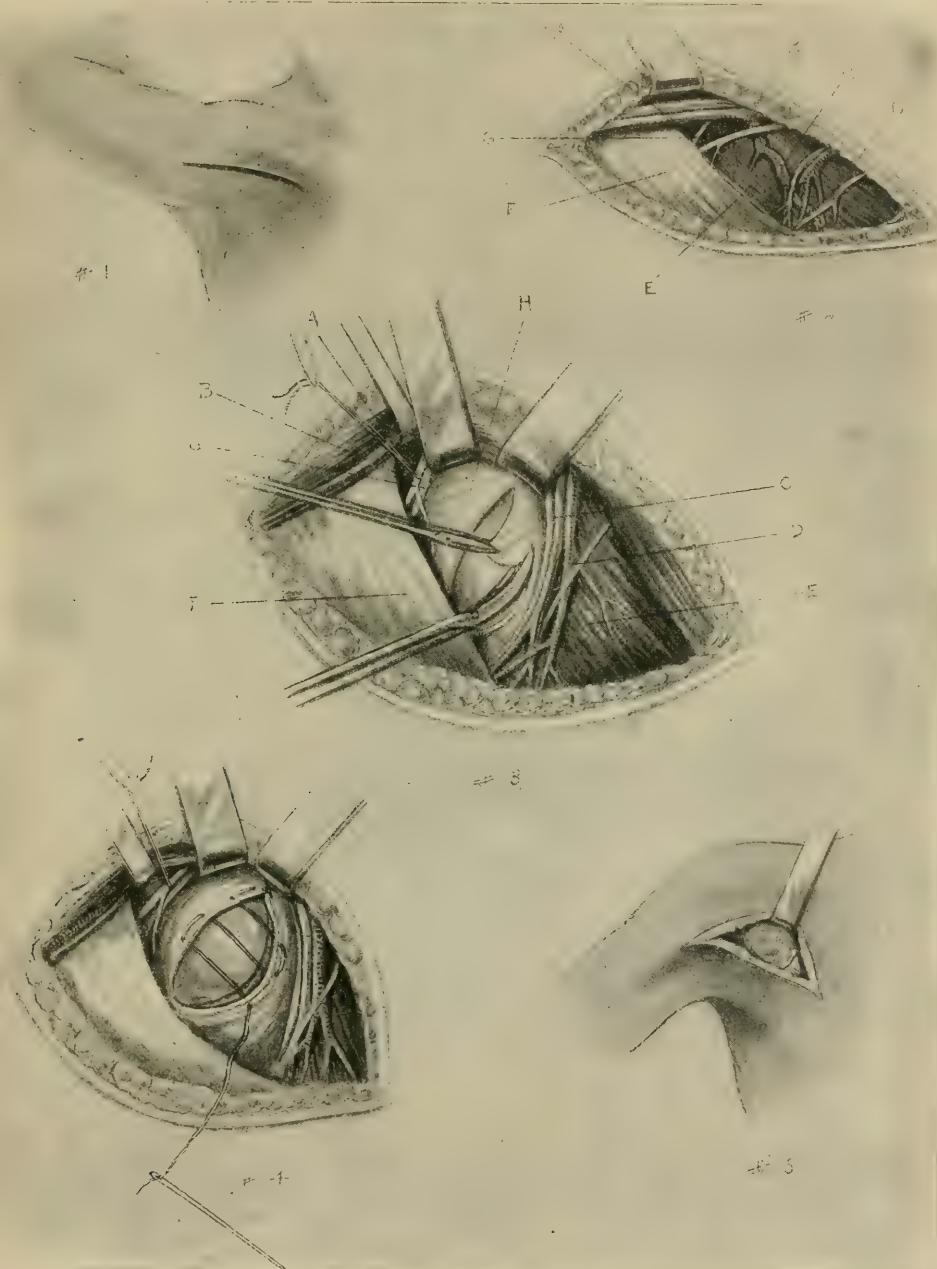


FIG. 57.—Showing the essential features of the capsule operation done through an incision posterior to the axillary vessels and nerves. It will be necessary only to locate, expose, and especially guard the circumflex nerve. *a*, Axillary artery and vein; *b*, circumflex nerve; *c*, subscapular artery; *d*, subscapular nerve to the latissimus dorsi muscle; *e*, subscapularis muscle; *f*, latissimus dorsi muscle; *g*, posterior circumflex artery; *h*, capsule. (Thomas.)

the stretched subscapularis, a permanent cure can be assured. He reports 40 cases, with no untoward results.

Dislocations of the Semilunar Carpal Bone.—Cohn,¹²⁵ in reporting 1 case which has occurred in the surgical clinic at the Touro Infirmary, first comments upon their infrequency. This certainly is not the experience in the active surgical clinics with which we are connected. In fact, it is a far more frequent complication than is realized, and the lack of recognition, especially in industrial cases, has resulted in much unnecessary disability and compensation. The common mistake of treating such injuries as sprains cannot be justified at the present time



FIG. 58 (19514).—Dislocated semilunar carpal. (Cohn.)

with the general accessibility of the *x*-ray (Fig. 58). To be content without an *x*-ray examination, even in cases of joint injury where there is no disturbance of anatomic landmarks, merely pain and some swelling, and to make a clinical diagnosis of sprain, if not malpractice, certainly exposes one to damage suits by the patient. A diagnosis of this condition cannot be made with certainty without the aid of properly taken roentgenograms, and stereoscopic roentgenograms are probably of the greatest service.

¹²⁵ Annals of Surgery, May, 1921, No. 5, p. 621.

In discussing the treatment, he is guided by two principles: (1) The possibility of completely reducing the dislocated bone, thereby restoring it to normal function; (2) if reduction cannot be effected by manipulation, will permanent removal interfere with the function of the joint? In recent cases it is possible at times to reduce the dislocation by manipulation. However, in old unreduced dislocations, reduction is rarely possible. The space normally occupied by the dislocated bone usually becomes more or less filled by new tissue or the remaining carpal bones become so closely approximated that complete reduction is impossible. Incomplete reduction, of course, will result in permanent limitation of motion. Piersol considers the function of the first row of carpal bones to be that of a meniscus, and, if so, the same treatment should be applicable here as in a dislocated cartilage of the knee—that is, removal. There is no question that good function is obtained after removal. Cohn's method of approach was through the incision suggested by Thompson for exposing a lower end of the radius. A linear incision, beginning at the radial styloid and extending upward for about two inches, was made, the supinator longus was retracted to the radial side; the radial artery and nerve were retracted with the superficial flexors to the ulnar side; the pronator quadratus was exposed, after which the anterior carporadial ligament was incised, thus exposing the first row of carpal bones. The dislocated semilunar came readily into view. The deep flexor tendons were seen superimposed on the dislocated carpal bone. By cutting the interosseous ligament, the semilunar was mobilized completely and removed. The wound was closed without drainage and the patient encouraged to move the hand as soon as he roused from the anesthetic.

Dislocation of the Carpal Scaphoid.—Ewing¹²⁶ reports a case of a man who caught his wrist between the top support and the side of an automobile. The wrist was twisted and the lever-like action caused dislocation of the scaphoid. Three days after the accident there was marked swelling of the wrist, discoloration, and thickening of the joint, with constant pain. A roentgenogram showed the dislocation, the scaphoid being anterior and the long axis at right-angles to its usual position. Reduction was accomplished by traction, with adduction and direct pressure over the displaced bone.

Tuberculous Hip Disease.—Halfdan Sundt¹²⁷ found, upon investigating the subsequent course of all discharged patients from the Fredricksvern Coast Hospital (Norway), who had been treated for surgical tuberculosis, that tuberculosis of the hip was much less common than was once supposed. Thus, in 243 cases of supposedly tuberculous hip-joint disease, 29.6 per cent were proved non-tuberculous. He suggests that it is possible when Perthes's disease becomes more generally known as a benign disease, fewer cases will be diagnosed tuberculous. He warns against all previous statistics and states that if from these statistics the benign and non-tuberculous cases could be excluded, the prognosis of true tuberculosis of the hip would be found to be much

¹²⁶ Journal of the American Medical Association, April 16, 1921, **76**, 1078.

¹²⁷ Tubercle, London, April, 1921, **2**, 289.

more unfavorable than has been supposed. In spite of all modern diagnostic methods, he confesses that it is impossible to establish a positive diagnosis of hip-joint disease in about 10 per cent of the cases.

Reduction of Old Dislocations of the Hip by Open Incision. Fixing the period of four weeks as the time beyond which the luxation of fracture was considered old, Buchanan¹²⁸ has found 45 cases reported in literature, 80 per cent of which had good results following operative reduction, 9 per cent had moderate improvement or poor results. He reports 1 case with a dorsal dislocation of the hip and a transverse fract-

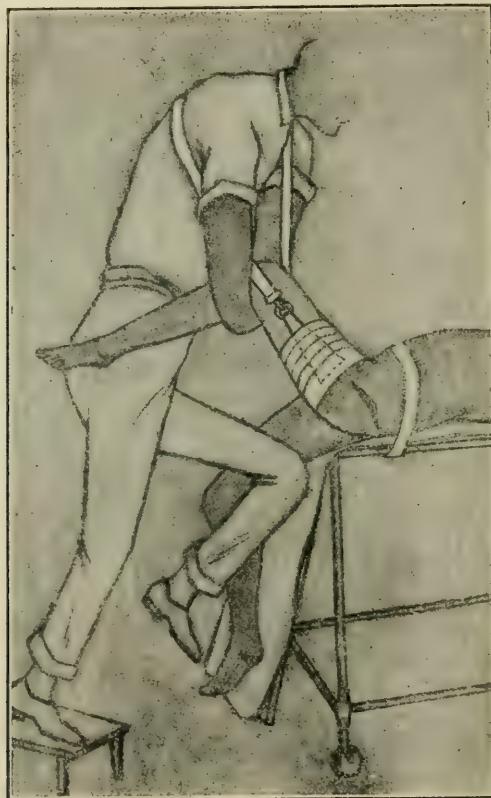


FIG. 59.—Reduction by body traction. (Buchanan.)

ure at the junction of the shaft of the neck of seven months' duration. At the operation, the joint was exposed by the Kocher incision and deepened until the margin of the acetabulum was exposed. The cavity was found to be roofed over and filled with dense connective tissue and shreds of capsule. After dissecting this tissue away by means of strong scissors, the normal cartilage was exposed. In like manner the fibrous tissue was lifted and cleared from the anterior aspect of the great trochanter and the neck until the cartilaginous margins of

¹²⁸ Surgery, Gynecology and Obstetrics, November, 1920, No. 5, 31, 462.

the head were reached. The pelvis was then firmly fixed to the table by a band of webbing, the lower leaf of the table being dropped to permit of the position shown in Fig. 59.

By means of a harness and strap attached to the patient's thigh and the shoulders of the assistant, powerful traction was exerted. After cutting away the connective tissue about the head and the neck, four levers were passed under the neck, and, by the combined use of these levers, the manipulation and traction of the assistant, the head was delivered to the margin of the acetabulum and then to its cavity. There seemed to be no disposition for it to leave the socket after it was replaced. The external branch of the Y-ligament was uninjured, but the internal branch had been separated. Profound shock developed during the close of the operation. He concludes: (1) Traumatic hip dislocations may be considered old at the end of four weeks; (2) reduction by manipulation is rarely successful after that time, owing to formation of connective tissues, which fills the acetabulum and binds down the head and neck; (3) reduction by open incision is to be preferred in nearly all cases of old luxation of the hip and with the modern methods it is attended with but little danger; (4) the actual replacement of the head, after the acetabulum has been emptied and the head and neck released, is best accomplished by manipulation or the use of levers with manual and body traction; (5) the result is often ideal and in the cases reported have been good in 80 per cent.

Osteochondritis Deformans of the Upper Femoral Epiphysis. Etienne Lorrell¹²⁹ adds 6 cases to the literature and summarizes his reports in the following way:

He first protests against calling it Perthes's disease, as it was described by Legg four years before Perthes wrote about it. The incidence is relatively rare. Of 1500 children treated for chronic osteoarticular lesions, only 6 had infantile osteochondritis deformans. Boys are more frequently attacked than girls. The maximum frequency is between five and nine years. Lorrell says the condition is rarely bilateral, which does not agree with Perthes's description, who cites a number of instances of bilateral development, and the only case that we have seen, which occurred during this last year, was a bilateral lesion in a girl. The anatomic lesions are shown only by the *x-ray*. The diaphysioepiphyseal cartilage is irregular, and clear zones seem to arise here and extend into the epiphyseal head and neck. The clear articular space, which is usually found, is abnormally enlarged. Lorrell considers this as the result of the pushing out of place of the head of the femur. The conditions often follow traumatism, but, in general, the onset is insidious.

Legg's, or Perthes's Disease.—Roderick¹³⁰ reports a large percentage of recorded cases with a history of a previous injury. It has also been noted after reduction of a congenital luxation of the hip. Evidence has been offered which points to syphilis as a predisposing factor.

Fairbanks¹³¹ also reviews the subject of osteochondritis deformans juvenilis and reports a bilateral case.

¹²⁹ Rev. d. Orthopédie, January, 1921, **8**, 31.

¹³⁰ Lancet, 1921, **200**, 210.

¹³¹ Lancet, 1921, **200**, 20.

Coxa Plana.—Waldenström¹³² suggests the name of coxa plana to the so-called Legg's and Perthes's disease. Calve¹³³ also approves of this name in preference to any other.

Anomalies of Ossification of the Patella.—Mouchet¹³⁴ calls attention to anomalies of the patella which are often mistaken for fractures in the adolescent and adult, and for tuberculous lesions in children. Roentgenographic studies alone can make the diagnosis. Little is known of the manner of ossification of the patella. Probably in a small number of cases it is from more than one center, and at times this makes a confusing picture. He also calls attention to the necessity of roentgenographing both knees, and, when the condition is congenital, there is usually a corresponding abnormality in the other knee.



FIG. 60.—Before reduction.

Forward Dislocation of the Astragalus and, with it, the Foot.—In our review in the December number, 1919, we reported in detail Down's article upon the backward dislocation of the astragalus, and in the *Annals of Surgery*, March, 1921, No. 3, 73, 381, Levering and Lee report the same type of case, in which a perfect result was obtained after tenotomy of the tendo Achillis. Dinegar¹³⁵ has been able to

¹³² Lyon Chir., February, 1921, **18**, 7.

¹³³ Presse méd., Paris, May 14, 1921, **29**, 383.

¹³⁴ Paris médicale, April 19, 1921, **15**, 289.

¹³⁵ Annals of Surgery, October, 1920, No. 4, **72**, 494.

collect 26 cases of the backward variety; forward, 10; inward, 26; outward, 27; and upward, 4.

The mechanism of its production was as follows: His right leg and foot were advanced about two and one-half feet in front of the left lower extremity. The patient's weight was being borne on the right leg, while the left was being used to balance with. The left leg was tense from the contraction of the muscles, extended at the knee, the foot dorsi-flexed at the ankle. The right leg was slightly flexed at the knee and the foot was at right angles with the line of the tibia. While in this position the patient was suddenly hit on the left heel by a rapidly



FIG. 61.—Before reduction.

moving beam of great weight. The astragalus, and with it the foot, was dislocated forward; at the same time the patient lost his balance, falling upon his left side and inverting his left foot. The foot appeared lengthened, cold, cyanosed; the heel was shortened; motion impossible, the normal sulcus on each side of the tendo Achillis obliterated; the hollow of the instep increased. Under anesthesia traction on the os calcis and dorsum of the foot, the fingers of the hand making traction of the dorsum of the foot so as to push the astragalus down and backward. Countertraction was applied at the knee. It slipped into place easily with almost instant disappearance of the pain and cyanosis and the foot felt warmer.

The Surgical Treatment of Bunions.—The value of good feet is not appreciated until middle age, when they are compelled to carry a greater weight than during youth and when new shoes must be fitted



FIG. 62.—Hallux valgus.

to the feet rather than the feet to the shoes. The feet, unfortunately, are frequently moulded during the second and third decades of life by



FIG. 63.—Bony deformity in bunion.

abnormal types of shoes, too short or misshapen at the toe, causing the joint of the great toe to turn outward and thus develop a hallux valgus. In the majority of cases this deformity is in females. The fashionable

women's shoes usually has a heel of two and one-half inches, or more, in height, making it necessary to walk on an inclined plane. Hallux valgus is often associated with bunion and bunion rarely occurs without hallux valgus (Figs. 62, 63, 64, 65 and 66). It is probable that the over-



FIG.—64. X-ray of foot with bunion showing exaggerated space between inner and outer metatarsal bones and displaced sesamoid wedges.

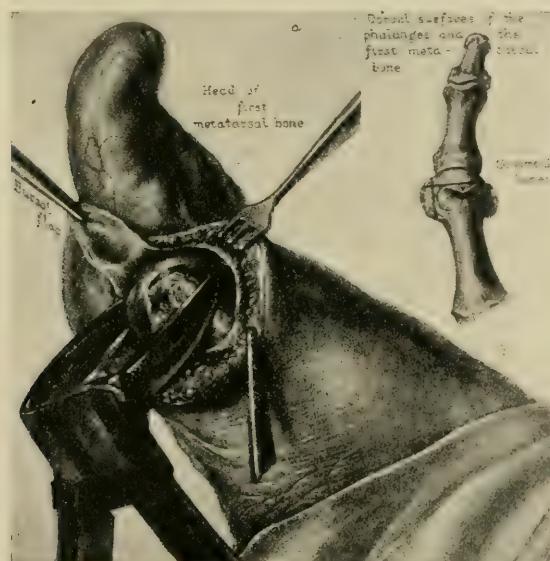


FIG. 65.—(a) Removal of head of metatarsus; (b) angle at which head of metatarsus is removed, showing short incision at right angle to long incision.

growth of bone that occurs in this condition, which is in the region of the terminal whirls of the capillary circulation where the joint capsule is attached to the periosteum, is of the same origin as the overgrowth which occurs in rheumatoid arthritis, a mild chronic infection, the localizing factor being that of traumatism, since such growths occur and increase during the period of life in which rheumatism and recurring infection occur. The various shapes of feet and the limited number of shapes of shoes are undoubtedly responsible for the development of bunions and hallux valgus. Further, they occur more commonly in feet in which the great toe is longer than the second and third supporting toes and rarely occurs on a foot whose great toe is shorter than the second and third toes, the so-called square foot.

Beneath the head of the great toe are the triangular sesamoid bones on either side of the flexor tendon. In the displacement of the flexor tendon, which occurs in hallux valgus, the sesamoid bones slip to the

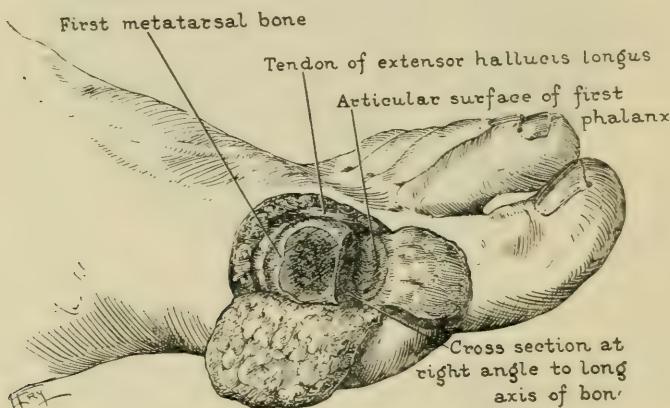


FIG. 66.—Excision of bony overgrowth and part of the head of the bone with preservation of the bursa.

inner side of the head of the great toe and become a bony wedge at each step, forcing apart the first and second metatarsal heads. The operation which Mayo¹³⁶ here describes consists in dissecting forward the bunion bursa, the bursa being left attached to the surface of the first phalanx (Fig. 66). One-quarter inch of the head of the articulating surface is removed by a bone saw or a large bone-biting forceps.

This shortening of the metatarsal bone relaxes both the extensor and flexor tendons. The bony projection on the inner side of the head of great toe is then removed, when the bunion bursa is turned into the joint and held in place by sutures of catgut which also serve to straighten the great toe, thus removing the valgus.

The Chief Lesions following Fracture of the Spine. The diagnosis of cord injury and fracture of the spine is usually very difficult by x-ray and cannot be eliminated unless views be taken from different angles.

¹³⁶ Collected Papers of Mayo Clinic, 1919, 11, 1024.

Stereoscopic pictures are the safest. Many patients show a gradual improvement after injury to the cord, and this group admit of a hopeful prognosis. However, those in which the cord symptoms become progressively alarming are not necessarily hopeless. The cause of progressive disability is generally an undrained hemorrhage in or about the cord, which had resulted in the formation of scar tissue with sacculations about the meninges which fill with fluid. If the arachnoid is dissected free from the adhesions, normal circulation of spinal fluid will prevent the formation of cysts. Sharpe¹³⁷ warns against the dissection of scar tissue from the cord, as the result is similar to that experienced when trying to remove scar tissue from any other portion of the body, namely, to aggravate the condition. Severe injuries to the cord except by hemorrhage rarely follow fractures of the vertebral bodies alone and resulting from indirect violence as the main support of the spinal column is through the articulations on the transverse processes. Of course, the ultimate fate of the damaged and many of the sound fibers of the cord will depend upon whether their depression by bone, hemorrhage or edema is temporary or permanent. If the pressure continues longer than four days, secondary degeneration usually sets in. When the cord symptoms appear late, the formation of bony callus or hemorrhage is usually the cause, and a laminectomy is imperative in these cases. If, at operation, complete laceration of the cord is found, it should be sutured, not with the hope of restoration of function, but to avoid the development of trophic disturbances.

Compression Fracture of the Vertebral Bodies with Delayed Symptoms. (*Kuemmel's Disease*). This condition, which is more frequently seen in neurological than surgical clinics, Baker¹³⁸ characterizes by the following features: A spinal injury followed by temporary symptoms of short duration and no local evidence of diagnostic importance, subsequently delayed symptoms of pain, disability and local signs of bony injury, especially kyphosis. In 1895, Kuemmel presented 5 cases of this type of spinal lesion with a discussion of the characteristic symptoms.

In his series, the injury was the result of a fall. The essential features at the first observation were pain, more or less localized over some point in the spine, limitation of motion of the type seen in muscle injury, and a disability period lasting but a few days. At a latter period, varying from weeks to months, without history of a second injury of like nature, the patient develops pain at the sight of the former injury with increasing disability. Objectively, there will be found a localized tenderness over the spinous processes at the point of the previous injury, with more or less local prominence of the spinous processes. Kuemmel was at first inclined to consider the condition a traumatic osteoarthritis, but later considered it a type of fractured spine. Kocher, Trendelenburg, Oberst and E. Frankel considered it as a type of compression fracture of the vertebral body. These reports were, of course, before the use of the *x-ray*, and it is probable that some of them would have been recognized at the time of the injury if such methods of examination had

¹³⁷ American Journal of Surgery, May, 1921, 35, 152.

¹³⁸ Surgery, Gynecology and Obstetrics, October, 1920, p. 359.

been available. Baker, however, reports 4 cases in which the initial roentgenogram was negative for a bony lesion, which upon subsequent examinations, after varying intervals, showed in the roentgenogram compression fractures of the vertebral bodies. Based upon this experience, Baker presents the theory that there is a type of compression fracture of the spinal bodies which is apparently benign at first, and gives no *x-ray* evidence of a bony lesion, but in which, at some later period bony changes develop, and these can be readily demonstrated by the *x-ray*. Probably there may be some such cases among that indefinite and troublesome group of traumatic neuroses and "railway spines" so frequently found in our large clinics. The improvement in our *x-ray* technic in the last few years has, of course, made possible this explanation of bony changes. Baker anticipates the criticism that the *x-ray* pictures show changes which might be due to tuberculous changes, by definitely stating that they are in no way like tuberculous bone, and that none of the cases reported after a long period of observation have developed pus.

As regards the prognosis of such fractures, he urges the earliest possible diagnosis. Frequent *x-ray* examinations should afford the earliest evidence of the condition. The final prognosis will surely depend upon the time that the prognosis is made and the treatment begun. In regard to the treatment, it consists in adequate fixation of the spine over a long period of time.

Sacralization of the Fifth Lumbar Vertebra.—Hayes¹³⁹ refers to his experience with the excision of the offending transverse process in this condition, which he says has not been successful.

The Use of the Bone Graft in Pott's Disease. There are increasing references in literature to the use of autotransplantation of bone in the treatment of tuberculosis of the spine. Lopez Duran¹⁴⁰ reports 24 cases treated in this way, and concludes that in adolescence in adults, with little or no kyphosis, recovery occurs more certainly and rapidly after this procedure than by conservative treatment. But in adolescence in adults with advanced dorsal or lumbar kyphosis, the results are not so good. He advises against operation upon children under six years of age and cases in which there are either fluctuating abscesses or fistulæ.

Radulesco¹⁴¹ also prefers the operative treatment to the conservative orthopædic care because it insures complete and permanent immobility of the vertebral column in the pathological segment, it spares a good deal of pain to the patient and shortens the duration of the treatment.

Gorres¹⁴² says that Albee's method of implantation of bone in Pott's disease is ideal.

Duran¹⁴³ reports operating upon 24 cases in which it was successfully used.

Scalone¹⁴⁴ routinely employs the bone-graft method of Albee, except that he employs two grafts instead of one.

¹³⁹ Dublin Journal of Medical Sciences, April, 1921, 4th series, p. 152.

¹⁴⁰ Arch. Espan. Pediat., Madrid, January, 1921, **5**, 5.

¹⁴¹ Presse Médicale, Paris, April 9, 1921.

¹⁴² Ztschr. f. Orth. chir., Stuttgart, February 26, 1921, **40**, 502.

¹⁴³ Arch. Espan. Pediat. Madrid, January, 1921, **5**, 5.

¹⁴⁴ Chir. d. organi di movimento, 1920, **4**, 505.

Tuberculosis of the Spine.—Myerding¹⁴⁵ reports 100 cases operated upon at the Mayo Clinic from 1912 to 1918 by a modified Albee bone-grafting method. Previous treatment had been unsatisfactory in all of them, and it had consisted in the application of casts and braces, and in 3 of them bone grafting had been done elsewhere. It is their experience that the most favorable results have been obtained by careful selection of the patients to be operated upon, and the continuance of

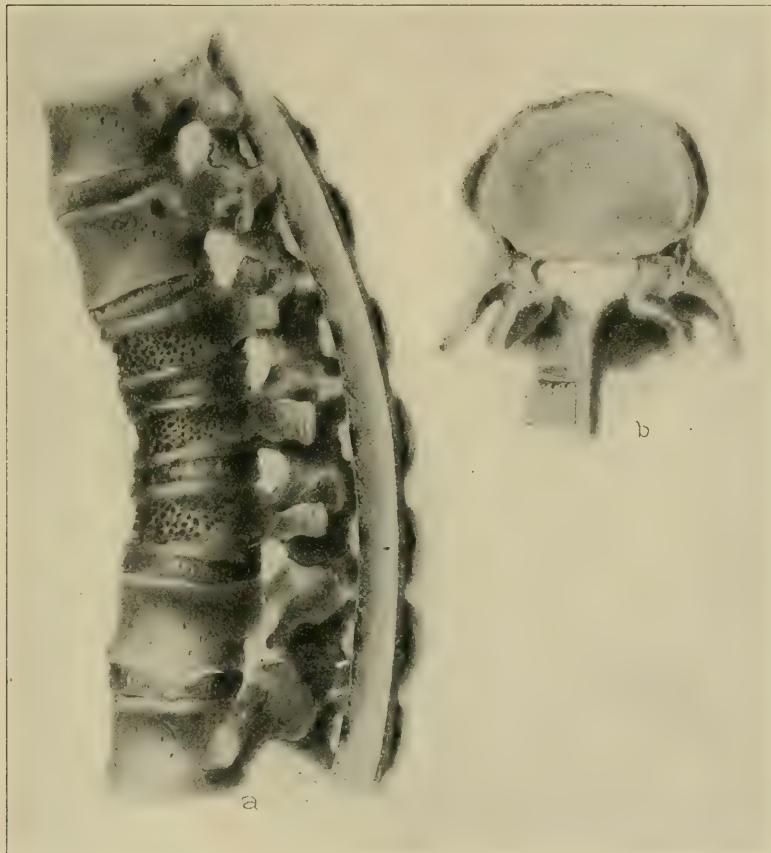


FIG. 67.—*a*, Modified Albee operation; lateral view shows a curved graft placed so as to bridge two vertebræ above and two below the tuberculous lesion; *b*, superior view shows graft in position. (Meyerding.)

the conservative treatment after operation, until, in the judgment of the surgeon, the disease has been arrested. The bone graft used in their cases was curved to fit the deformity (Figs. 67 and 68). Their practice conforms with that of most surgeons in avoiding operation and using conservative treatment for the very young and those adult patients who present formidable complications, namely, patients under five and

¹⁴⁵ Collected Papers of Mayo Clinic, 1919, 11, 735.

adults with suppurating sinuses and active pulmonary tuberculosis. Inasmuch as the lesion in the spine is a local manifestation of a disease which has probably had its origin in a primary focus in some other part of the body, the general hygienic care of the patient is of first importance and should be added to any other form of treatment used. Myer-



FIG. 68.—*a*, Incision in the skin to expose the flat internal surface of the tibia. The dotted line represents outline of curved bone graft removed by bone saw; *b*, cross section of tibia showing the shape and comparative size of graft. (Meyerding.)

ding is very conservative in his after-treatment. A cast is always applied and worn for the first six weeks, when a brace is fitted and the patient is allowed to be up and about. In his interpretation of a cure, relief of pain and ability to return to their former activities, he considers as being definitely promoted by operation. All patients are advised against heavy manual labor. Eighty-six per cent of the

patients in the series were relieved of their symptoms. Eight per cent have died since operation.

The Coincidence of Cervical Ribs and Syringomyelia.—Bassoe¹⁴⁶ reports 3 cases of this kind and reviews the literature in which there are quite a number of references to the association of these two conditions. Our interest in this report is a peculiar one for we have had presented for operation a girl, aged twelve years, in whom the *x*-rays show a cervical rib, and Burr diagnosed syringomyelia.

In Streissler's¹⁴⁷ review of the subject of cervical rib, he accepts Oppenheim's view of their being degenerative stigmas. He mentions scoliosis in the cervical and upper thoracic region as a frequent association and does not consider it secondary to the cervical rib, also spina bifida and other malformations, such as hare-lip, cryptorchidism, dislocated lenses, club foot, congenital lipoma; finally, combinations with psychoneuroses, syringomyelia, multiple sclerosis, muscular atrophy.

The first case reported was previously reported by John D. Murphy,¹⁴⁸ in which he gives the following graphic description: "Now you can see in the field the anterior portion of the cervical rib; instead of being a round, blunt process, it is articulated and exhibits a sharp dentate edge which nips the brachial plexus and accounts for the pain radiating down along the arm to the forearm and hand. The plexus has been displaced." After removing the rib he added: "With the rib out of the way, it is clearly to be seen where the brachial plexus was compressed by the rib. The nerve to the rhomboids was involved, showing that the fifth cervical nerve from which this branch takes origin, felt the stress of the compressing rib. The knife-blade-like edge of the cervical rib had irritated the brachial plexus until a membrane formed upon one of its constituents—the eighth cervical from which the ulnar nerve is derived." A postscript dated two months later says: "The patient made an uneventful recovery, and at the present time the preoperative thickening which was present in the lower portion of the left side of the neck has, to a great extent, subsided." This apparently happy ending was really only the introductory chapter to this patient's troubles. One year later distinct areas of analgesia were found along the outside of the left arm and forearm, and absence of the wrist and elbow reflexes on the same side, while these reflexes were normal on the right side. He was carefully examined two years after Murphy's operation by Spiller, who made a definite diagnosis of syringomyelia. Bassoe, from this experience with 3 cases, concludes that he is inclined to regard all bearers of cervical ribs with extreme suspicion and to accept them as possessed of well-balanced minds and structurally normal central nervous systems only after very close examination. His 3 patients whose local symptoms had led him to advise operation, which in every case was a surgical success, were made definitely worse, 1 passing through a severe postoperative psychoneurosis, the other 2 have led miserable lives for years as profound hypochondriacs with a persistence

¹⁴⁶ Archives of Neurology and Psychiatry, November, 1920, No. 5, vol. 4.

¹⁴⁷ Die Halsripen, Ergebni. d. Chir. u. Orthop., 1913, 5, 280.

¹⁴⁸ The Clinics of John D. Murphy, April, 1916, 5, 227.

of the local symptoms in spite of repeated subsequent exposures of the brachial plexus and injections of procain and dilute alcohol. On the other hand, good results from operation are reported by so many reliable observers that it would seem, for the present at least, that operation should be discouraged only in those cases in which the symptoms of degenerative stigmas are also present.

Adventitious Ligaments Simulating Cervical Ribs.—According to Law,¹⁴⁹ about 10 per cent of cervical ribs give local and peripheral symptoms, and, when they do occur, they are exhibited in the root of the neck and in the forearm and hands, and are expressions of nerve irritation, with motor and sensory changes, with loss of trophic control and with ischemia of the extremities from vasomotor changes. These symptoms are now thoroughly well established and recognized.

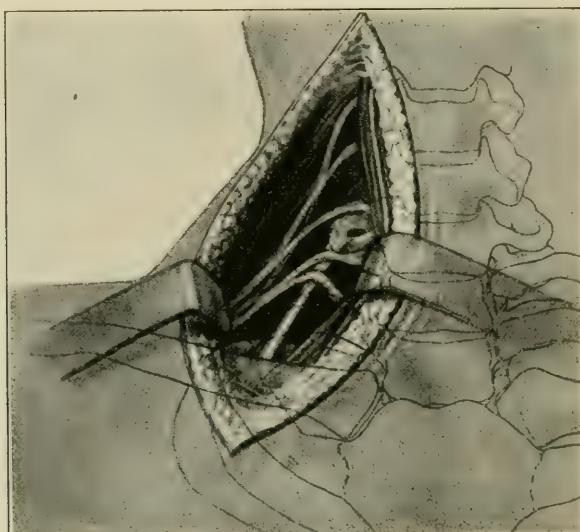


FIG. 69.—Schematic drawing showing angulation of lower cords of brachial plexus over adventitious ligament. (Law.)

There is still much discussion as to the mechanics and physiology by which these symptoms are produced, Todd and Kieth asserting that these circulatory changes result from pressure upon the sympathetic fibers in the lower cords of the brachial plexus. Other observers are equally positive that the anemia results from a mechanical obstruction and angulation of the subclavian artery at the site of the offending rib. Law made the observation, while studying a series of cervical ribs, that in the cases of some of the shorter and more rudimentary ribs the forward projecting tips of these ribs were occasionally attached by a definite ligament to the first rib or the sternum.

In those cases presenting themselves for relief of symptoms, typical of a cervical rib and yet in which the roentgenographic evidence showed

no hypertrophy or elongation of the transverse process of the seventh cervical vertebra, they explored the neck and found a definite adventitious ligament arising from the normal seventh cervical transverse process and inserted into the first rib at the scalene tubercle with the scalenus anticus muscle. The ligament was about 4 mm. in width and 2 mm. in thickness; it was as taut as a bowstring and tightly stretched over it and sharply angulated were the two lower cords of the brachial plexus and the subclavian artery. Mobilizing the phrenic nerve and pulling it aside, the scalenus anticus muscle was sectioned and then the adventitious ligament; when the ligament was cut, the marked tension upon the nerve and artery was immediately relaxed. They report 4 cases in all. The ligaments in all of these cases were tightly stretched, and while all had their origin from the tip of the seventh cervical transverse process, they varied markedly in their point of insertion, for one was inserted with the scalenus anticus muscle into the scalene tubercle of the first rib and another into the costoclavicular ligament, the third into the sternoclavicular ligament, and the fourth well toward the midline into the interclavicular ligament close to the head of the clavicle. In none of the cases was there a dilatation of the subclavian arteries distal to the ligament. The nearest description of anything resembling the complete ligaments is described by Zukor Kandel, who, in his dissections, discovered that there were certain inconstant and extremely variable bands which have been associated with Sibson's fascia and which are occasionally found reinforcing and helping that fascia to fix the dome of the pleura. This fascia and associated fasciculi, according to Zukor Kandel and the French observers, Poirier and Sharpy, is derived in man from a tiny rudimentary, inconstant muscle, which itself is extremely variable in its origin, distribution and insertion, the so-called scalenus minimus muscle; this little muscle, unusual in the human, is normal to a number of the Simian species. A knowledge of their occasional presence may help to explain some of the circulatory and trophic conditions of the hand and arm of obscure etiology which heretofore, from want of exact knowledge, we may have designed as Raynaud's disease, intermittent claudication, spontaneous gangrene or thrombosis.

Traumatic Surgery. The big problems in accident surgery are the prevention and cure of infection of the soft parts, the management of fractures and injuries of the joints, tendons and nerves, and the after-care of the injured. Of these, the management of infected wounds and the care of broken bones are the most important part, because 75 per cent of our patients have wounds of the soft parts or broken bones. It is important to remember that these were the problems of war also, and some of the greatest surgical lessons of our recent military experience are applicable to these our postwar traumopathies.

It is a regret, and a reproach also, that out of the war has arisen no universally-accepted treatment of infected wounds or fractures, despite the fact that the attention of surgeons the world over was focussed on these two problems. In our last year's review, we stated that military surgery had not added to our previous surgical knowledge and as time elapses this becomes more generally appreciated. The French mili-

tary surgeons brought forth the best preventive method of wound treatment by stressing mechanical sterilization, and exsection of damaged tissues (*débridement*); Louvard, at the close of the war, called attention to the fact that this supposedly new method had been advised and practised in all of its essentials during the Napoleonic wars by Larrey. Moorehead¹⁵¹ believes that the one applicable gain or contribution of our military experience to civil surgery is the recognition that crippling from injury is preventable by early care and that deformity can be minimized by later care of the injured. This gain is in the terms of restoration of function, for the two basic factors in traumatic surgery are: (1) Safety; and (2) conservation as related to life, limb and vital organs.

The elements which Moorehead outlines as leading to earlier return of function after injury are found reviewed under the heading—Wounds, Burns, Joint Injuries, Fractures and Reeducation.

Wounds. Sterilization is the key to success and we have only two methods to accomplish this, namely mechanical and chemical sterilization. The first of these means that we cut away all bruised, frayed and devitalized tissues, realizing that the bacteria develop only in tissues robbed of their normal blood supply, and that healthy tissue is inimical to their growth. This mechanical treatment is needed only in crushed wounds of the soft parts and in grossly compounded fractures, and he practises it only when they receive the patient within the first twenty-four hours after the injury. This *débridement* is really not sacrificial to the tissues, as only enough of the soft parts are removed to encounter free bleeding, normal color or contractile tissue.

For the ordinary wound, chemical sterilization suffices if we can make antiseptic contact with every part of the dried wound. He uniformly cleanses the wound surfaces with gasoline, benzine or kerosene, removes all débris or foreign bodies and then bathes the part freely with full strength tincture of iodine. In a wound with a small or tortuous orifice, the iodine should be introduced by a syringe so that we may be assured that all of the wound tract is iodized.

He summarizes his paper as follows:

The basic factors in traumatic surgery relate primarily to the treatment of infected wounds, burns, fractures and joint injuries.

Safety first, conservation next, are the two essential considerations.

Sterilization of wounds by mechanical or chemical means is the end in view, and after sterilization suture should be attempted.

Burns are, from a clinical standpoint, wounds due to heat and should be placed in the wound class, as thereby our patients will measurably profit.

Fractures are wounds of bones and are always associated with wounds of the contiguous parts. Splintage should be of the removable type to permit inspection, massage and motion.

Physiotherapy should begin early and should not be regarded as applicable only to the late stages.

Functional return is the greatest aim in all forms of injury, and no

¹⁵⁰ Journal of the American Medical Association, June 11, 1921, p. 1642.

patient should be regarded as cured until function has been restored to the maximum.

Traumatic surgery is not trivial surgery; on the contrary, it often demands a higher grade of surgical skill and experience than the average of general or pathological surgery.

The Surgical Use of the Bone Graft.—Albee¹⁵¹ reviews what he calls certain fundamental laws underlying the surgical use of the bone graft. He believes that the secret of the success of an inlay bone graft follows Nature's laws of biology, physiology and metabolism, and is based upon the transplantation of healthy active bone cells to replace those which have lost their osteogenetic activity.

The graft, in his opinion, should always, if possible, be autogenous, and either a sliding inlay from one of the fragments or taken from the tibia or some other source. It should also be the internal fixation agent as well as the active osteogenetic element. It must receive early and adequate blood supply, not only for its favorable growth, but for its very cellular existence. Since its blood supply must come principally from the marrow substance, which is the main normal source of blood supply in bone, the graft should contain marrow as one of its definite component parts. In fact, in order that the fundamental laws pertaining to tissue transplantation be fulfilled, the graft must consist of all four bone layers, namely, periosteum, compact bone, endosteum and marrow, and, further, the tissue layers must be brought into apposition with the corresponding layers of the host-bone, in as nearly perfect apposition as is possible. The graft should be so placed that its marrow substance may serve both as a vascular and as an osteogenetic bridge extending from the marrow of one host fragment to the marrow of the other. In other words, it must lie in generous, extensive contact with the untraumatized marrow substance of the host fragments on either side of the hiatus at the point of non-union. It should also fit with a cabinet-maker's exactness, thereby favoring the early establishment of blood supply and allowing, to the maximum degree, the operation of Roux's law of frictional irritation. It is obvious, to obtain these conditions, the large inlay graft is practically the only one which will insure them. Osteoperiosteal, the pedicled and the intramedullary grafts, he condemns. The osteoperiosteal graft is not only inadequate for the purpose of fixation, but also as an osteogenetic factor. He never employs it because he feels that any kind of bone graft should consist of all four bone layers. Endosteum and marrow are always lacking, and therefore it is not a complete osteogenetic unit. The pedicled graft, which has been used so much in ununited fractures of the jaw, he calls a snare and a delusion in that it rarely fulfills its only indication, namely, the transmission of blood to the graft. Either by traumatism of the pedicle or by its twisting, the bloodvessels do not remain patent. In place of the osteoperiosteal graft, Albee uses what he now calls a sliver graft. This is obtained by the motor-saw in the same manner as in the large inlay grafts, namely, by cutting through

¹⁵¹ Annals of Surgery, August, 1921, No. 2, 74, 196.

the full thickness of the cortex into the marrow substance. The grafts are obtained by single saw cuts and are about 1 mm. in width and 6 cc in length. Its greatest value, of course, is in its use as a supplement to the main fixation graft, for the purpose of furnishing additional foci of bone growth.

Henderson,¹⁵² in a discussion before the orthopaedic section of the American Medical Association, in Boston, 1921, based his statements upon the records of 413 patients, in whom bone transplantation had been performed during the eight years between January 1, 1913, and January 1, 1921. Of this group of patients, 166 suffered from tuberculosis of the spine, while the remaining 247 were practically all operated upon for ununited fractures.

Spinal Transplants. The end-result of this operation is difficult to determine. Unlike the fracture group, the disabling factor is practically always a secondary manifestation of a tuberculous process elsewhere. The operation and subsequent mechanical treatment are only a part of the procedure so that conclusions in this group are more or less unreliable. Of the 132 patients traced, of a total of 141, 50 per cent were considered cured or had the disease arrested, 21.99 per cent were improved, 16.66 per cent were unimproved and 9.9 per cent died. The exact cause of death apparently in all of the cases was disseminated tuberculosis. Of these, 2.26 per cent died so soon after operation that they must be regarded as postoperative deaths, 1 from pulmonary embolism and 2 from tuberculous meningitis. Generally speaking, draining sinuses, no matter where they are situated, and active pulmonary tuberculosis contraindicate surgery of this kind. He also advises against grafting the bone under tension. In his experience, a few of the grafts loosened and one end protruded against the skin because they were inserted under tension. By taking the graft from the flat internal surface of the tibia, it can be sufficiently curved to fit almost any kyphos. In addition, he has found it of advantage to hold the transplant against the denuded spinous processes with beef-bone screws, using six thirty-two machine size screws carefully placed at some distance from the kyphos.

TABLE I.—SPINAL AUTOGENOUS BONE TRANSPLANTS.

Patients operated on previous to Jan. 1, 1921	. . . . .	166
Patients operated on previous to Jan. 1, 1920	. . . . .	141
Patients operated on previous to Jan. 1, 1920, traced	. . . . .	132
Cured (or disease arrested)	. . . . .	66 (50.0 per cent.)
Improved	. . . . .	29 (21.9 per cent.)
Unimproved	. . . . .	22 (16.66 per cent.)
Operative deaths	. . . . .	3 (2.26 per cent.)
Later deaths	. . . . .	12 (9.09 per cent.)

One hundred and sixty-six patients each with two large incisions gave four (2.4 per cent) infections. The graft was lost in two patients. Prominent kyphosis may cause ulcer. Four patients fractured the graft and 2 were reoperated on. Occasional loosening of one end of the graft occurred, owing to tension. A curved graft and beef bone screws should be used.

¹⁵² Journal of the American Medical Association, July 16, 1921, No. 3, 77, 165.

TABLE II.—AUTOGENOUS BONE TRANSPLANTS FOR UNUNITED FRACTURES.

	Traced.	Operations.	Success.	Failure.	Death.
Tibia	95	101	85	8	2
Femur	33	36	19	13	1
Radius	28	...	22	6	
Humerus	33	39	23	10	
Ulna	16	...	13	3	
Ununited knees	6	...	6		
Jaw	9	...	7	1	1
Patella	1	...	1		
Nose	1	...	1		
Sacro-iliac	1	...	0	1	
Total	223	...	177	42	4

There were 247 cases in all, but only 223 were traced, with 177 (79.3 per cent) successes, and 42 (18.8 per cent) failures. There were 4 (1.7 per cent) deaths, 3 due to influenza; 1 due to a cerebral embolus in a femur case. Tibia, 101 operations on 95 patients, giving 84.1 per cent successes. Femur, 36 operations on 33 patients, 52.7 per cent successes. Humerus, 39 operations on 33 patients, 56.4 per cent successes.

TABLE III.—AUTOGENOUS BONE TRANSPLANTS FOR UNUNITED FRACTURES.

	Infected			Infected			Graft lost.
	Clean cases.	Number.	Per cent.	Previously infected.	Number.	Per cent.	
Tibia	73	4	5.4	29	9	31.0	4
Femur	34	3	8.8	2	2	100.0	2
Radius	28	5	17.8	7	3	42.8	3
Humerus	27	4	14.8	7	4	57.1	5
Ulna	17	2	11.7	1	1	100.0	1
Ununited knees	9	1	11.1				
Jaw	9	1	11.1				
Patella	2						
Nose	1						
Sacro-iliac	1						
Total	201	20	9.9	46	19	41.3	15 (6%)

There were 39 (15.7 per cent) infections in the entire 247 cases. In the 201 cases in which there had not been any previous infection, there were 20 (9.9 per cent) infections. In the 46 cases in which there had been previous infection, there were 19 (41.3 per cent) infections.

The operation is in no sense radical, and there cannot be a thorough removal of the tuberculous tissue as is offered in a resection of the knee. Though it has not been possible for him to study a group receiving the same rest and fixation in bed as the grafted cases have received, he is under the impression that in patients subjected to bone transplantation for tuberculosis of the spine the results are more favorable than in those not operated upon. Owing to the uncertainty of the fate of the bone graft in children, he seldom advises operation for them. Finally, because the theory of the operation is logical and it provides a better means of control of the average patient, he will continue to advise the operation in adults.

Transplants for Delayed Union, Non-union and Other Conditions. In this group there were 247 patients. As he views them, they were "difficult to treat successfully." One hundred and thirty-nine had been operated upon elsewhere, from one to six times. Fifty-nine had been infected.

In the entire group of 247 patients with ununited fracture, 223 were traced. Of these, 79.3 per cent were considered successes; 18.8 per cent were failures. An attempt to study the failures by percentage is useless, since the causes were diversified. Infection was the most prominent cause of failure, but does not necessarily mean failure. Faulty technic, poor coaptation of the fragments to each other and to the graft, poor external fixation and lack of coöperation on the part of the patient may all tend to put undue stress on the graft and cause its fracture. In not a few instances union has eventually occurred, even after fracture if subsequent fixation and control were applied. Osteoporosis of the fragments is an unfavorable condition and should be overcome, if possible. When this exists, Henderson advises a preliminary removal of all casts and splints and the use of the part in order to get the bones in better condition to receive the transplant. It is almost a certainty that union will be obtained with the bone graft when the ends of the bone are eburnated, as in pseudarthrosis of many years' standing. From this study, he feels the most favorable bones to deal with are the tibia, ulna, radius, humerus and femur respectively.

In explaining his infections in the group of ununited fractures (15.7 cent), he divides them into two groups, those in which there had been no infection previous to his operation, in which the rate of infection was 9.9 per cent, and the second group which had been infected prior to his operation, with a percentage of 41.3. His explanation of the 9.9 per cent infection in the clean cases is that most of the operations were difficult and prolonged, resulting in traumatization, exposure and drying of the tissues. He makes the rather surprising comparison with the general surgical cases at the Mayo Clinic, and quotes Sistrunk as authority for the statement that the average infection in clean cases is about 10 per cent. Infection developed in a few cases because of breaking-down of the scar tissue in the deep structures and occasionally because of sloughing of the skin. In their earlier work, the intramedullary plug was used with indifferent success, and the inlay graft, which was used later, was not followed by as high a percentage of infection. Though the inlay graft is as nearly as is possible an anatomic approximation of tissue, in a certain percentage of cases, though the operation has been satisfactory in every respect, the graft broke about the fifth to the eighth week. It is generally accepted at the present time that bone transplants, at least in a great part, are absorbed and replaced by new bone. During this period of absorption and replacement, there is a period when the graft itself is weakened by the process of absorption, while the new bone is still too soft to be of any real support. At this stage a slight strain may cause fracture of the graft. If the massive graft is used, its very size gives a margin of safety not provided by either the intramedullary or the inlay graft. Henderson

feels certain that his results have been improved by using the massive graft and planting it in the fragments by the aid of beef-bone screws, and where there is sufficient muscle and soft tissue to cover it comfortably he proposes to continue its use. The size of the massive graft when applied to the tibia increases the tension of the overlying skin and may cause a necrosis of the skin and death of the graft because of exposure to the air. If the affected bone is osteoporotic, he employs an inlay graft from the opposite extremity; if not, the sliding inlay reversible method is used.

Reconstruction of the Hand. Taylor¹⁵³ states that in the treatment of traumatisms and infections which result in impaired functions, the hand comes next in importance to the brain and the eye from a wage-earning standpoint. In a research to improve, if possible, the results usually obtained in restoring or preserving the function of the hand, Taylor included lesions of the fingers, hand, wrist, forearm, involving changes in the skin, fascia, palmar spaces, bursae, nerves, bones, articulations, ligaments, muscles and tendons. Among the factors which cause impairment of function in the hands are infections, penetrating wounds, deep burns and operative traumatism. In his paper, he confines himself to loss of function in the tendons. He very properly emphasizes that the conservation of function of the tendons begins with the primary operation. A correct diagnosis of the original lesion and a perfect operation provides maximum results. Unfortunately, it is just as true that incorrect diagnosis and maltreatment at the primary operation result in a large number of seriously deformed hands after laceration and infection. It is the latter group which often makes perfect functional restoration impossible. It is needless in this place to quote, as Taylor does, the commandments of Kanavel which are so ably expressed in his "Infections of the Hand." No accident ward of a general hospital should be without this monograph and no surgeon should be allowed to treat infections of the forearm and hand who does not know its contents by heart. If this was more general, the necessity for much of the reconstructive work of the hand would be eliminated.

In his discussion upon operations upon the tendons, his first point is the necessity for a bloodless field, which is obtained by first applying the rubber Esmark bandage, and then applying a rubber tourniquet above the internal condyle of the humerus, previously protecting the ulna, by covering it with a gauze pad. The skin incision should not be over the point of the desired tendon suture, but a crescentic or semicircular flap should be dissected back at the beginning of the operation so that the point of suture should not lie under the line of suture in the skin, because of the danger of its being caught in the skin scar and thus interfering with ultimate motion. He also warns against the danger of the drying of the tissues during the operative exposure, and advises the covering of the tendons and other tissues with pledges of absorbent cotton wet with normal salt solution. In order to avoid even the traumatization of a thumb forceps or hemostat in handling

¹⁵³ Surgery, Gynecology and Obstetrics, March, 1921, No. 3, 32, 237.

the ends of the divided tendon, Taylor devised a clamp which is shown in Fig. 70. He also describes a new technic in applying the sutures which we have employed very successfully (Fig. 71). Its advantages, according to Taylor, consist in a more perfect application of fine silk sutures, leaving a minimum of silk exposed to produce possible traumatic adhesions. Two fine straight cambric needles are threaded, one on each



FIG. 70.—The author's accepted type of clamp made of clock spring.

end of a strand of fine intestinal silk. With the tendon clamp applied as close as possible to the end of a cleanly severed tendon, the first needle transfixes the tendon just beyond the clamp. It passes through the tendon obliquely, coming out of the first fenestrum on the near side. The same needle reënters the tendon, and, passing obliquely through it, emerges at the second fenestrum on the far side, again reënters the tendon, passes through obliquely and coming out of the free end of the tendon when the first needle is removed. Then with the second

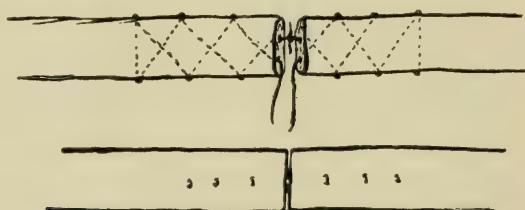


FIG. 71.—Above, diagram shows the course of the silk through the tendons and end-to-end tying. Below, lateral view of end-to-end approximation of tendons. Dots of silk are the only evidence of this method of suturing.

needle the same sort of procedure is carried out, only in the reverse direction, passing obliquely through the first fenestrum on the far side, the second on the near side and, finally, emerging through the free end of the tendon opposite to the end of the first suture. Thus, it will be seen that none of the silk remains exposed on the side of the tendon except as small dots, where the suture has emerged and reëntered the tendon.

When a similar arrangement of sutures is placed in the other tendon, the four silk strands are tied, closely approximating the severed ends and the excess of silk is cut away so that the two knots are entirely buried between the cut ends of the tendon.

Reconstructive Surgery and its Application to Civilian Practice. The defects and deformities of the human body, resulting from injury and disease furnished in such wholesale quantities during the war, have provided many valuable lessons in reconstructive surgery. Undoubtedly, the most important is the emphasis that has been placed upon the ultimate function obtained in the individual rather than our old efforts at restoration of the contour and anatomical structure of a part. Thus, Starr¹⁵⁴ emphasizes that it is just as easy to place a limb in such a position, during the period of treatment that the best functional result will be obtained if ankylosis should unfortunately occur, as it is to place it in a bad position.

The best positions for ankyloses, as outlined by Starr, are the same as given by Jones (reviewed in December number of PROGRESSIVE MEDICINE, 1920, p. 309). The shoulder-joint in abduction of about 45 degrees from the body, with the elbow slightly in front of the anterior axillary line. The elbow-joint, if only one is involved, at an angle of flexion of 110 degrees or slightly straighter than a right-angle; if double, the left arm at 120 degrees of flexion and the other at 75 degrees or slightly more acute than a right angle. If pronation and supination are lost, the forearm should be placed in slight pronation, about half way between the midposition and complete pronation. Many of the cases with loss of pronation and supination can be remedied by a removal of the head of the radius, after which a useful range of motion is secured. The wrist-joint should be fairly markedly hyperextended, as only in this position can the flexors of the fingers act to advantage. The hip-joint should be in abduction, and slight flexion of about 15 degrees. The knee-joint should be straight in all workers and only in very exceptional occupations, such as professional callings, should any flexion be permitted. The ankle-joint should be at right angles to the leg, except in cases where there is a large amount of shortening of the extremity, when a toe-drop is permissible.

He has made an interesting observation about the extensive scars and adhesions which have followed the generous débridement so universally practised to prevent sepsis. In his experience with the Canadians, the ultimate functions of the limbs, where the excision of tissue was from the large and bulky muscle structures of the gluteal region or thigh, and in many cases of the upper arm, has been exceptionally good, and warrants similar practice, when necessary, in civilian injuries with infection. He speaks with enthusiasm of the dramatic results obtained in restoration of function by tendon transference in irreparable nerve injuries. The upper extremity lends itself most admirably to this type of surgery.

The thousands of cases of nerve injury occurring in the war have

¹⁵⁴ Surgery, Gynecology and Obstetrics, April, 1921, **32**, 311.

been a great opportunity for study, but, taken as a whole, the results of sutures of injured nerves have been disappointing. The nerves which are wholly motor or wholly sensory have yielded infinitely better results after treatment. The reason for the greater percentage of failure in the latter has been due probably to the inability to coapt similar areas in the proximal and distal ends. Further, it has been found that nerve suture early after injury have done better than those sutured late. All of this is in accord with our review of last year, in which the works of Platt, Frazier, Elsberg were reviewed.

Flat Feet.—**CAUSES OF FLAT FEET.** Rugh¹⁵⁵ draws attention to *three definite mechanical defects* of an anatomical character frequently *the cause of weak and flat feet*.

1. The first of these is a shortened tendo Achillis. Schaffer was one of the first to call attention to this, hence it is sometimes called "Schaffer's foot." Rugh's examination of the feet of 50,000 recently inducted soldiers showed that 12 per cent possessed heel tendons which would not permit of dorsi flexion of the foot to, or beyond, a right-angle when the foot was held straight or slightly adducted and the knee straight. The routine examination of a group of women entering training school has shown that 30 per cent are affected in this manner. The difference in the height of the heel worn by men and women explains this greatly increased number among women. When the tendon of Achilles is shortened, the forward tilting of the leg on the foot in walking throws a tension on the tarsal and metatarsals which produces one of two effects; either the heel is lifted from the ground as the body swings forward, or it remains on the ground as the foot is rotated outward. The former usually occurs in parallel or inverted foot walking and the latter is encouraged in everted foot walking, and by far the greater majority of persons walk in the latter manner. This outward rotation naturally throws more body weight and strain on the inner side of the foot (the weak side), and mechanical strains from disturbed balance is the inevitable result. One constantly meets with patients (especially women) who claim they cannot wear low-heeled shoes, and before denying this the surgeon should make sure that the heel tendon is not shortened. In patients under thirty-five years of age, Rugh has made it a practice to lengthen the tendon subcutaneously by partial division at different levels followed by thorough stretching. After this age, mechanical treatment is preferable, as muscle restoration and resumption of power and function are not so well assured as in younger persons. Many orthopaedic surgeons claim that they can efficiently stretch the tendo Achillis by mechanical means and special shoes. We agree with Rugh in not having been able to accomplish this by such means, except where the shortening has recently followed the wearing of a high-heeled shoe and the fibrous elements had not yet undergone organic change. The simplest and best mechanical device is the elevation of the heel of the shoe or the insertion of a pad inside of the shoe under the heel of the foot. It must be remembered that a shoe heel cannot be

¹⁵⁵ Annals of Surgery, April, 1921, No. 4, 73, 499.

raised or lowered more than a quarter of an inch without interfering with the lines of the shoe and throwing strain upon the vamp, but a higher heel may be prescribed than the patient is wearing. Also the shoe heel should not be more than one and a half inches high in its entirety; if greater there is a disturbance of the normal proportion of weight-bearing between the heel and the ball of the foot which give rise to other disabilities of great severity. It may also be necessary to combine with the elevation of the heel a wedging of its inner edge, and also of the sole to secure adduction of the foot and to throw the body weight directly over the center of the foot.

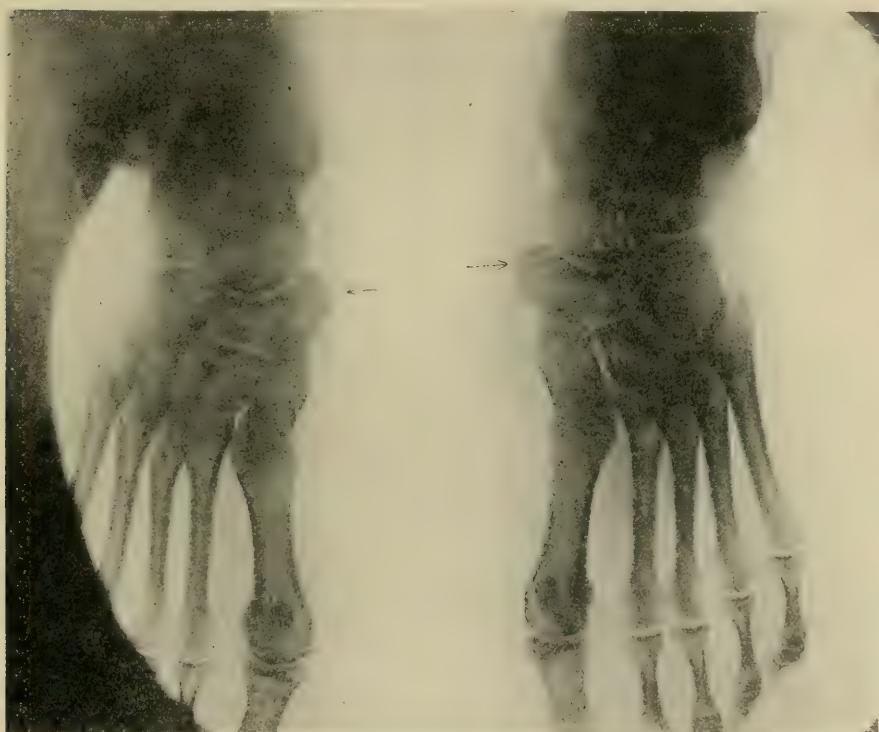


FIG. 72.—Hypertrophy of scaphoid. Abducted feet.

2. The second condition that mechanically predisposes to a weak or flat foot is a hypertrophy of the inner end of the scaphoid bone (Fig. 72). When this occurs, the inner border projects inward beyond the line running from the border of the head of the astragalus to the internal cuneiform, and curls backward along the inner edge of the astragalus. In these cases, the articulating surface of the head of the astragalus will often be found to extend further backward on the neck than normally. In the well-balanced foot the inner edge of the head of the astragalus, the border of the scaphoid, and of the internal cuneiform are nearly in a straight line, but, if the scaphoid is prolonged inward, it forms, by

its relation with the inner surface of the head and neck of the astragalus, a mechanical obstruction to adduction of the forepart of the foot. This enlargement is easily felt under the skin and is commonly mistaken for the head of the astragalus. It can, however, be readily felt to move independently of the astragalus when the forefoot is abducted and adducted. An anteroposterior view of the tarsal bones taken with the feet straight will bring out the accurate relations of the bone. Attempted adduction of the front part of the foot will be found to be limited by the impingement of the elongated process of the scaphoid

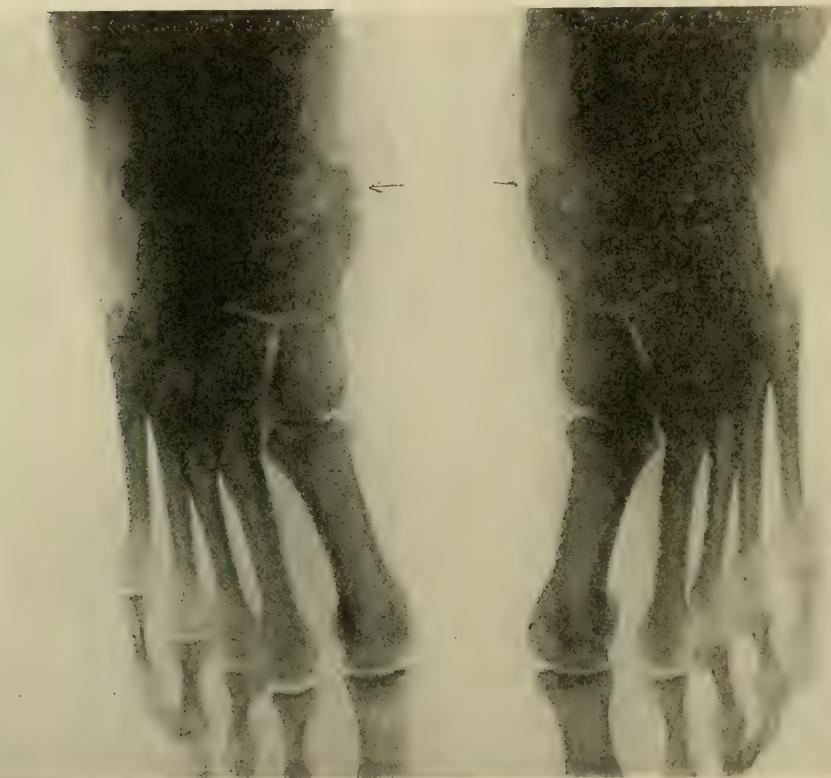


FIG. 73.—Two large tibiale externum in a bad case of flat feet.

upon the head and neck of the astragalus, and when the foot is thus adducted the process completely covers the head of the astragalus on the inner side. The tendon of the tibialis posticus is attached to this portion of the scaphoid, and the insertion covers the entire inner surface of this bone. When the bone is in this relation, there is a mechanical disadvantage in the pull of the muscle and its ability to hold the foot in adduction. This disturbance of muscle pull readily permits of a slight degree of abduction, throws a strain upon the remaining structures of the arch and predisposes to the onset of a weak and ultimately of a flat foot. In all such cases the outward movement of the forefoot

(abduction) is greater than the inward, and, when the strain once begins, the muscle spasm sets in and the pull of the peronei becomes a very important and very potent factor in the increase of the faulty posture. Rugh believes that these prominences are developmental in character and are, when present, the determining factor in producing foot strain.

3. The third clinical factor is a supernumerary tarsal bone placed at the inner side of the scaphoid and over which runs the tendon of the tibialis posticus. This bone is called the tibial externum and by some regarded as a sesamoid bone in the tendon of the posterior tibial muscle (Fig. 74). It is developed by a separate center of ossification and may be entirely separated from the scaphoid, looking like a rounded sesamoid,

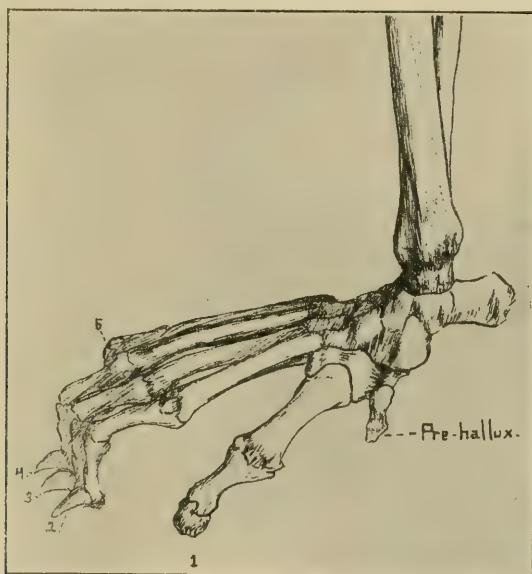


FIG. 74.—Right hind foot of opossum (*didelphys*).

or it may articulate with the inner end of the scaphoid, having a distinct joint structure between them; or it may have a synostosis with only a thin line of cleavage; or it may be firmly fused with the scaphoid, forming a hook-like projection along the inner side of the head and neck of the astragalus. According to Dwight, it is found in many mammals. We have seen this very distinctly in 3 cases. Rugh advocated removal of the supernumerary bone and the inner end of the scaphoid and the reattachment of the tendon of the tibialis posticus further forward on the scaphoid or even attaching it to the internal cuneiform. A subperiosteal implantation of the tendon is made and it is better to strip off a thin layer of bone with the tendon than separating it from the scaphoid to insure a more firm and reliable union for future strain.

Monahan¹⁵⁶ speaks of this same deformity as the human prehallux and says that it has two possible interpretations: (1) It may be regarded as an evidence of diseased and degenerate feet, whose degeneracy allows old and once-atrophied structures to redevelop; or (2) it may be looked upon as Nature's normal and healthy effort to brace a rapidly abducting member and adjust it to its ever-increasing responsibility. Thus, it may be an open question whether the human prehallux is a reversion to a lower ancestral form or whether it represents a further stage in evolution and foreshadows a future, normally six-toed human foot (Fig. 74). He concludes, however, that it is directly homologous with the prehallux as seen in many of the lower animals and has its origin, doubtless, in some ancestral form of the past that was common to all succeeding types. Its immediate origin may be considered the dormant ossification center left in all feet by atrophied fin-rays.

It is not a congenital structure in human feet, but appears usually between the ages of twenty and forty years, in association with some constitutional disease, notably syphilis or tuberculosis.

Amputations. Better methods in teaching and practice have certainly resulted from the recent war experience, and Corner¹⁵⁷ summarizes them in this article. Beginning with leg amputations, all have been abandoned from the metatarsophalangeal joints up to the high Syme above the ankle-joint. The high Syme will probably remain, as it gives a very good stump. Corner condemns the loss of the front of the foot because no spring to the foot remains, and the artificial limb that has to be applied is unhandy because of the broader ankle and the necessity of wearing shoes of different sizes. Again, in some instances the tendo Achillis becomes attached to the scar and tilts the stump forward, resulting in the patient bearing the weight on the scar. He feels sure that the easier and more satisfactory operation of amputation through the middle of the leg will replace all amputations below this point. Not only do patients amputated in this region have just as satisfactory function as those with a high Syme, but the upkeep is much less expensive. Care should be taken to make the skin flaps with the anterior larger than the posterior in order to make the scar posterior. By such a procedure, of course, the amputations of Teale, Hey and Faraboeuf are dispensed with. Ascending the leg, the operations of Lister, Gritti and Stokes-Gritti, which retained the patella, are no longer desired by the limb-makers. In addition, experience has shown that the patella often becomes loosened and drawn forward by the quadriceps. The only amputation remaining of the lower extremity is of the thigh performed with anterior and posterior flaps planned so as to place the scar posteriorly.

The practice in amputation at the hip has also been modified, and Corner feels that the operation described by Huggins will replace all others. It is really an amputation through the neck of the femur by means of an anterior racquet incision. Skin flaps are used and the

¹⁵⁶ American Journal of the Medical Sciences, November, 1920, **160**, 708.

¹⁵⁷ Lancet, January 15, 1921.

muscles are cut short so that they cannot push the artificial limb off the tuber ischii. The resulting scar is anterior and pulls the skin flap tight over the tuberosity. He calls attention to the uselessness of amputating less than three inches above or below the knee-joint, nor is it of any use to amputate through the thigh, leaving less than three inches of the femur below the lesser trochanter. If this amount of bone cannot be saved, the amputation through the neck of the femur will provide the best artificial limb.

In the upper extremity, all forearm amputations should be done with equal anterior and posterior skin flaps and circular division of muscles and bone. No amputation should be performed less than three inches below the elbow-joint. In the upper arm amputations should be done by a circular incision, which, as one nears the axilla, is modified by an internal incision along the vessels converting the circular amputation into a racquet amputation. The same incision should be employed for shoulder-joint amputations.

Preliminary Ligation of Common Iliac Artery in Hip-joint Exarticulation. Hip-joint amputation was first discussed in 1729 by Morand. Kerr, of Southampton, completed the first attempt in 1774, while there are at least two survivals recorded by Larrey in the time of the Napoleonic wars.

In reviewing the opinion of various authors as to the actual cause of the high mortality following hip-joint amputation, loss of blood stands paramount. In the order of their importance are hemorrhage, shock and sepsis. Shock is so closely related to hemorrhage that a concise definition is impossible. Its prevention, control and relief are so dependent upon the preoperative precautions, operative technic and postoperative care, that they will not be discussed at this time, while sepsis at the present time is a factor in such a small number of cases that it should be eliminated. When death follows so formidable a procedure from shock, hemorrhage, or both combined, it usually occurs before serious infection has time to become established.

Hip-joint disarticulation rarely is an emergency procedure, and sufficient time to prepare the general conditions for the procedure is usually provided.

Bailey,¹⁵⁸ realizing that none of the usual tourniquet methods insure perfect control of hemorrhage and that if this is practically the only factor which our surgical technic has not mastered, suggests the preliminary ligation of the common iliac. By this method such complete control of hemorrhage from the stump is obtained that the application of from six to ten hemostats is sufficient to assure a dry field. From the 2 successful cases that he reports, he concludes that a preliminary ligation of the common iliac is a perfectly safe procedure in hip-joint disarticulation from the standpoint of continued viability of the stump, and that hemorrhage is absolutely under control, time is saved and shock materially diminished.

PRACTICAL THERAPEUTIC REFERENDUM.

BY H. R. M. LANDIS, M.D.

Acetyl Salicylic Acid (Aspirin).—This drug is so well known to the medical profession and laity—that a word is necessary to explain that the word “aspirin” was a trade name patented by a chemical company, the predecessor of the Bayer Company, under which acetyl salicylic acid was marketed for seventeen years.

One pound of acetyl salicylic acid can today be purchased by a druggist for approximately the same price as one ounce of aspirin cost during the “patent period.” Today acetyl salicylic acid can be bought by the druggist for seventy-eight cents a pound. After the patent on aspirin expired, other manufacturers entered the market with acetyl salicylic acid which they sold under the name of aspirin. Civil suit was entered by Bayer Company¹ against the United Drug Company for selling its product under the name “aspirin.” The United States District Court of southern New York recently rendered a decision in this matter. This decision, which seems to be a compromise, is of importance to physicians. The ruling of the court notes that acetyl salicylic acid is known as such to manufacturing chemists, pharmaceutical houses, pharmacists and physicians, that to them the word “aspirin” signifies only the produce of Bayer origin, whereas the term “acetyl salicylic acid” is unknown to the average layman, though the term “aspirin” is. The pharmacist, therefore, according to the court’s ruling, is justified in supplying a layman who asks for aspirin with acetyl salicylic acid tablets of any reputable maker. But the court rules—and this is the important point—that when a physician writes “aspirin” in a prescription, only the Bayer product can be supplied. Unless a physician wishes to cater to the concern holding the Bayer rights and to aid in perpetuating what was a monopoly for seventeen years, he should be careful to prescribe the drug under the term “acetyl salicylic acid.” The court now places the responsibility directly on the medical profession. Avoid “aspirin”—write “acetyl salicylic acid.”

Adrenalin has furnished the basis for numerous investigations during the past year. Like a number of other drugs whose action is specific in certain conditions, a constant endeavor is being made by observers to extend their field of usefulness. During these experiments, considerable additional information is obtained as to the pharmacology of the drug. It has been known clinically that the action of local anesthetics acts considerably enhanced by the addition of small quantities of adrenalin which is by its constricting action on the blood-vessels.

¹ Journal of the American Medical Association, May 14, 1921, p. 2356.

Meltzer and Auer² report that the result of their experiments shows conclusively that a subcutaneous injection of adrenalin into the ear of a rabbit causes an intensive constriction which is conspicuous for its duration—from three to eight hours. Compare the subcutaneous injection of adrenalin, which lasts from three to eight hours, with the intravascular injection of adrenalin, which causes a rise in the blood-pressure but for a maximum observed of seven minutes. The further away the subcutaneous injection is made from the central artery, the greater is the length of time it takes the adrenalin to manifest its constricting properties. After the effects of the drug have become exhausted, it must be remembered that the constricted vessels show a tendency to the opposite effect, vasodilatation.

Adrenalin has been suggested as a drug which, if administered hypodermically, would be of value in *testing the functional capacity of the heart*. Fulchiero³ shows by means of tracings that results obtained, following the hypodermic injections of adrenalin, were not reliable on account of the multiformity and varying responses depending on the condition in the endocrine system of different individuals. The test may be of some value if used and considered as follows: Inject hypodermically 1 to 1.5 cc of a 1:1000 solution of adrenalin and if there follows a considerable increase in pressure without the production of extra systoles, indications are that there is a good quality of myocardial activity; on the contrary, the appearance of extra systoles, even with a relatively slight increase of blood-pressure, testifies to the insufficiency of the myocardium, all other things being equal.

In the study of the *adrenalin hypersensitivity in tuberculous and in the non-tuberculous subjects* made by Heise and Brown,⁴ very important observations were made.

The adrenalin reaction was twice as frequent in the non-tuberculous as in the tuberculous (14 and 29 per cent respectively). The activity of the lesion, as determined by symptoms, played little, if any, part in the occurrence of the reaction. Presumptive inactivity, as determined by roentgenoscopy, was accompanied by adrenalin hypersensitivity about two and a half times as often as when activity was present. No patient who gave a history of pleurisy with effusion reacted to adrenalin. The occurrence of tubercle bacilli seemed to be associated with a less frequent reaction than when the tubercle bacilli were absent (10 and 17 per cent respectively).

As the extent of the disease becomes greater, the tendency to give a reaction to adrenalin apparently diminishes (27 per cent, 15 per cent, and 9 per cent). Hypersensitivity to adrenalin is apparently not developed in tuberculous colitis.

Goetsch's *adrenalin test* is one which demonstrates a constitutional hypersensitivity to a subcutaneous dose of 0.5 cc of the 1:1000 solution of adrenalin chloride. According to Goetsch, hyperthyroidism, whether or not associated with tuberculosis, will give a positive

² Journal of Pharmacology and Experimental Pharmacology, April, 1921, p. 177.

³ Riforma Medica Naples, December 11, 1920, p. 1147.

⁴ American Review of Tuberculosis, Baltimore, October 4, 1920, p. 609.

reaction to adrenalin. Tuberculosis uncomplicated by hyperthyroidism does not react positively to adrenalin. Goetsch reports 12 cases in which the diagnosis of tuberculosis, either probable or suspicious, was made, and which have in practically every instance undergone a rigid anti-tuberculosis therapy extending over years. The majority of the patients were referred to him from Trudeau Sanatorium or from Loomis Sanatorium. A positive adrenalin response helps to place the diagnosis on an impersonal basis, for, on the basis of clinical symptoms and examinations, the syndromes of the two diseases in the early stage are so similar.

It is a matter of importance from the standpoint of therapy that the adrenalin test is of value, namely that whereas tuberculosis responds rather promptly to a well-regulated life, due to thorough rest, these cases of mild hyperthyroidism are but little benefited, even after prolonged periods of inactivity.

Adrenalin has been tried and found to be of value by Rathery and Bordet⁵ in the treatment of 4 cases of *uncontrollable vomiting* in women at the second or third month of their pregnancy. Evidently the underlying cause of the vomiting was suprarenal insufficiency, as under the adrenalin treatment their recovery was complete in forty-eight hours. The dosage was a daily total of from 4 to 8 mg. given by various routes and continued from four to seven days.

Collip⁶ found that the fall in blood-pressure, when small doses of adrenalin were given, was antagonized by various tissue extracts. Full doses of adrenalin produced a rise in blood-pressure which is augmented and prolonged by the administration of tissue extract.

The difference in the *cardiovascular reaction to doses of adrenalin* has been commented upon by Clough.⁷ He has classified the effects of the subcutaneous injection of 1 mg. of adrenalin, as follows: Negative, moderate, marked and very marked.

In the moderate reaction there was: (1) A rise of from 15 to 30 mm. Hg in systolic blood-pressure associated usually with a fall of from 10 to 20 mm. in diastolic pressure; (2) the increase in pulse pressure, which was often doubled; (3) there was usually a slight tachycardia—other symptoms were generally slight. In marked reactions, increases of from 30 mm. Hg to 100 mm. Hg in the systolic blood-pressure were noted.

The diastolic pressure was usually slightly increased and a marked rise in the pulse pressure was noted. There were sometimes glycosuria, very often tachycardia, palpitation, pallor, mydriasis, tremor, nervousness and anxiety.

These changes were described as being due to two factors: (1) A direct stimulation of the heart, with increase in force of beat and in the volume output as well as the heart-rate; (2) constriction of the peripheral vessels. In the moderate, the first factor plays the chief rôle, whereas in the severe reactions vasomotor constriction is also of importance.

⁵ New York State Journal of Medicine, September, 1920.

⁶ Annals de Medicine, Paris, August, 1920, p. 92.

⁷ American Journal of Physiology, October, 1920, p. 447.

Atropine frequently exaggerates the response to a subsequent injection of adrenalin.

A slight or moderate response to adrenalin was made in 82 per cent of 32 normal individuals.

Patients with hypertension often showed severe reactions to 1 mg. or less of adrenalin regardless of the cause or degree of duration of the hypertension.

Clough concludes that, in spite of the present belief, adrenalin is not a direct means of maintaining the blood-pressure and that there is no satisfactory proof of an increased amount of adrenalin in the blood in human disease, or that high blood-pressure is due or associated with adrenalin overactivity. He explains the adrenalin sensitiveness in high blood-pressure as being due to the unusual well-marked blood-pressure response to exercise, emotion or excitement.

The response to pilocarpine and adrenalin in a series of 20 cases of *bronchial asthma* was studied by Alexander and Paddock,⁸ with the result that no constant associated condition was found. The most frequent finding in this series was abnormally increased sensitiveness to pilocarpine. The majority of the patients reacted also to adrenalin with an abnormal rise in blood-pressure and other characteristic signs—pallor, tremor, rigor—indicating increased sensitiveness to the drug. Cases reacting excessively to adrenalin were found to be relieved by 0.25 cc, a much smaller dose of the drug than is usually employed.

The effect of *adrenalin* on the *bronchioles*, as demonstrated by Prof. W. E. Dixon⁹ on a cat, showed that the result of two injections were to increase the volume of air entering the lungs as a result of dilatation of the bronchioles, and to cause a rise in blood-pressure. The effects were temporary.

The injection of adrenalin at times produces rather *alarming systemic disturbances*. Schiff and Baliut¹⁰ state that in the study of the effects of adrenalin on children it was noted that a preliminary injection of atropine may prevent the disturbances, as in a case described, in which a boy, aged thirteen years, with severe asthma developed syncope each time he was given an injection of 0.5 cc of the 1:1000 adrenalin solution. They also found that in a certain group of children, with small depressible pulse, adrenalin does not cause the usual rise in blood-pressure.

Lowrey and Wright¹¹ carefully selected and studied 78 *psychopathic cases with regard to reaction of subcutaneous injection of adrenalin* in an endeavor to determine if the difference in reaction would be of value in differential diagnosis as had been claimed for the test. Their conclusions were that the reactions were of no value, that in 54 of 60 cases of dementia precoox there was an increase in blood-pressure, 40 of these showing a rise of more than 5 mm. Hg. In 18 cases of other types taken for comparison, there was a depressor reaction in 4.

⁸ Archives of Internal Medicine, February 5, 1921, p. 184.

⁹ Jahrb. f. Kinderh., Berlin, 1921, p. 1.

¹⁰ British Medical Journal, August 14, 1920.

¹¹ Boston Medical and Surgical Journal, August, 12, 1920.

The effects of adrenalin in the treatment of total or partial heart-block was studied by Lutembacher¹² by means of tracings. His findings are most important, and are summarized as follows: That the beats of the auricles and ventricles are accelerated but independently of each other. The consequences are likely to be disastrous. The heart is unquestionably stimulated, but its effects on conductivity may be slight or *nil*.

Adrenalin given intravenously, while accelerating the ventricle beat, often entails long pauses followed by syncope.

This inhibition and disorderly action of the heart following the adrenalin may be most dangerous in its effects, especially so in case of complete dissociation of the auricle and ventricle beat.

From a review of the literature, it is very apparent that investigators are not fully in accord with the results from tests for hypersensitivity of adrenalin, especially as to its application as a factor determining early and doubtful cases of *hyperthyroidism* or aid in differentiating between tuberculosis and hyperthyroidism. Peabody, Sturgis, Tompkins and Weaver ("Adrenalin Hypersensitivity and its Relation to Hyperthyroidism")¹³ attempted to prove or disprove the value of the specificity of the test in diagnosis of hyperthyroidism. Their records show that many persons are hypersensitive to the drug who have no indication of hyperthyroidism. It is, of course, true that patients with hyperthyroidism may present hypersensitivity to adrenalin. This hypersensitivity appears to be present very commonly in very nervous persons. This group of workers have also noted that this hypersensitivity was present in 50 per cent in patients convalescent from acute infections, and in nearly the same proportion in soldiers with "effort syndrome." It seems wise, therefore, in view of so unfavorable criticism having been made of a test whose fundamental nature is unknown, not to attach any great value to its results.

Muirhead,¹⁴ a teacher in a medical college, who is a physician and a professor of pharmacology, describes his symptoms of *Addison's disease* with his successful treatment of the same. The treatment was begun by the use of 2 cc of 1:1000 solution of adrenalin chloride taken by mouth, which was without effect. The use of the dry suprarenal gland or of the dry whole pituitary gland taken by mouth gave no good results. Subsequently he returned to the use of adrenalin, but now hypodermically instead of by mouth. The injection of 1 ampoule produced marked sensations of exhilaration and increased strength. He, therefore, received from $\frac{1}{2}$ to 1 ampoule of 1 cc of 1:1000 solution twice daily for a period of six weeks, and 2 cc of a 1:1000 solution was given by the rectum twice daily for several months. He states that improvement was observed almost immediately from the hypodermic injections. He developed increased food tolerance and decreased abdominal discomfort. Before the injections he could not walk two blocks without extreme weariness and dyspnea, two weeks later he could walk a mile

¹² Presse Médicale, Paris, February 19, 1921, p. 145.

¹³ American Journal of the Medical Sciences, April, 1921, 161; 508.

¹⁴ Journal of the American Medical Association, February 28, 1921, p. 625.

without much fatigue. He has continued using ampoules of 0.2 cc of 1:1000 solution hypodermically daily; larger doses cause uneasiness and trembling of the extremities.

Alcohol.—The railroad authorities have maintained for some time that employees who used alcohol were to be dismissed because those who had to do with signals (red and green colors) did so with less efficiency than those who did not use alcohol.

Schulz¹⁵ studied the effect on red and green vision resulting from the ingestion of food and drink containing alcohol and caffeine. Exhaustive experiments were carefully performed on a number of individuals with foods containing these substances, with the following results: Alcoholic drinks, in even comparatively small quantity, reduced the ability to distinguish between light and dark green, and light and dark red. Red vision is more impaired than green.

In these times of illegitimately obtained liquor, it seems that not only the laity, but likewise the medical profession, must be constantly warned regarding the danger of this practice. Many of the so-called bonded and so-called Government guaranteed liquors are made by mixing them with wood, or methyl, alcohol, a deadly poison. Jackson¹⁶ in an editorial, urges that some of the measures suggested by Wood and Buller sixteen years ago to prevent blindness from wood alcohol be put more generally in effect.

Cutler¹⁷ states that as long as grain alcohol is not to be obtained, it is of greater importance that its poisonous substitute should be eliminated in beverages, extracts and drugs. Particular attention is called to the fact that poisoning may occur through inhalation or local application as well as ingestion. Industrial workers in the fumes of methyl alcohol should be protected from chronic poisoning.

Cutler also raises the question of tolerance acquired to methyl alcohol, and states this matter requires further study. He states that a physician, who has charge of employees in a formaldehyde plant in which wood alcohol is used on a large scale, reports no cases of acute or chronic poisoning that he knows of. This physician states he knows of employees who have taken wood alcohol for years with no bad effects. A Norwegian working for the physician would drink, usually once a month in a relatively short time, one quart of denatured alcohol, which he preferred to whisky, with no ill effect. This has been his practice for years.

Considerable difference in opinion continues to exist as to the EFFECT OF ALCOHOL ON FATIGUE AND MENTAL ACTIVITY. Among the various experiments performed at the psychological laboratory, Oxford, by McDougall and May Smith,¹⁸ were those dealing with the influence of alcohol in normal non-fatigued state; a few instances were encountered in which a decrease in the number of errors (in mental tests used) followed the taking of alcohol. In all instances but one, the experi-

¹⁵ Arch. f. d. Ges. Physiol., vol. 166, p. 127.

¹⁶ American Journal of Ophthalmology, 1920, 3, 150.

¹⁷ New York Medical Journal, April 3, 1920, p. 585.

¹⁸ Editorial British Medical Journal, November 6, 1920.

menter states most definitely that he felt very tired. In certain stages of recovery from fatigue, the taking of alcohol would therefore seem to be followed, according to the result of other tests, by an increased mental activity. The writers suggest that if the variance in the effects of alcohol noted under similar conditions are not purely personal, "then probably one reason for the very uncertain and contradictory results that investigators record with alcohol is the varying condition of the body with regard to fatigue."

Walter¹⁹ states that he observed that a German guide was able to easily and regularly drink 20 liters of beer in a day, which contained the equivalent of 37 ounces of absolute alcohol without exhibiting the least sign of intoxication. He was unable to find cases of cirrhosis of the liver or other signs of alcoholic poisoning, because of the enormous quantities of bock consumed in Berlin or in any other city of its size. This observation proves to his satisfaction that where alcohol is diluted twenty to thirty times with water, it is almost non-intoxicating.

The TREATMENT FOR POISONING BY WOOD ALCOHOL in the past has been, as a general rule, most unsatisfactory. The treatment has been largely symptomatic.

Isaacs,²⁰ in describing the various treatments which have been recommended, includes as stimulants caffeine, adrenalin, digitalis, camphor, oxygen, pilocarpine and also potassium iodide. He states that Gettler and St. George suggest saline or sodium bicarbonate infusions and phlebotomy, with repeated gastric and rectal lavage, and that Harrop and Benedict report the recovery of a patient following 5 per cent solution of sodium bicarbonate given intravenously. This treatment is based on alkalinization and elimination. The stomach should be washed out if the patient is not comatose and is received within twelve hours after taking wood alcohol. The solution for lavage should be a 1 or 2 per cent solution of sodium bicarbonate in warm water, after which 3 or 4 ounces of a 50 per cent solution of magnesium sulphate are then carefully poured in through the tube and left in the stomach. The patient is kept in bed, kept warm if the temperature is low, and is given 45 grains of sodium bicarbonate with 250 cc of water every two hours for six doses. Subsequently, the patient is given 45 grains of sodium bicarbonate with a glass of water three times a day one hour before meals. The urine must be kept alkaline to the methyl red test. Fluids are forced, and a liquid diet is given until the acute symptoms have disappeared. If the patient is comatose, or if cyanosis is marked, with depressed respirations, it is not well to wash out the stomach at first. Under such circumstances he gives 1000 cc of Fisher's sodium carbonate (0.37 per cent) or sodium chloride (1.4 per cent) solution at 99° F. slowly intravenously. No ill effects have been noted in his cases. If there are evidences of overdistention of the right heart, 100 to 300 cc of blood may be removed from the vein in the arm before the intravenous injection; for much restlessness, spinal puncture may do good.

After Fischer's solution, the breathing usually improves rapidly, the

¹⁹ British Medical Journal, November 6, 1920.

²⁰ Journal of the American Medical Association, September 11, 1920.

mental state clears up, and in from six to twelve hours the cyanosis has virtually disappeared. The patient must be kept in bed until all symptoms have subsided.

Zethelius²¹ has successfully used a *Spinal Puncture in Cases of Methyl Alcohol Poisoning*. The puncture was repeated three or four times in each case, and, from the standpoint of improvement in vision, it was very successful.

From experiments of Haskill and his co-workers²² on the significance of the *Acidosis of Methyl Poisoning*, carried out on dogs, it is apparent that the poisonous action is variable, but that the majority will succumb to a subcutaneous or oral dose of 8 cc per kilogram of body weight. Seasonal variance is a possibility of the difference in resistance. These workers state that while there was a reduction in the alkali reserve, as determined by the Van Slyke-Cullen method, in most of the animals examined, this is not invariably the case, and there is no parallelism between the reduction and the severity of the symptoms. Fatal outcomes have been noted with normal alkali reserves.

Caution is urged, due to the irregular findings of the changes of alkali reserves as compared with the evidence of intoxication, in the use of intravenous hypertonic solutions of sodium bicarbonate because of the disastrous results obtained by these workers.

Attractive as is the theory, the author's results agree with those of Davis and Whipple,²³ in that they were likewise unsuccessful in the employment of sodium carbonate in the treatment of delayed chloroform poisoning.

Alozoga²⁴ has reported that the disease known in Columbia as chichism is the result of abuse of the cheap native beverage known as chica, made from maize. He presents evidence to show that chichism is in reality pellagra. Under arsenic, nourishing food and abstention from liquor, the curable cases throw off the disease in a few months, but grave cases progress to a fatal termination.

Amyl Nitrite.—The diagnosis of mitral stenosis has been aided by intensification of doubtful presystolic murmurs upon the inhalation of amyl nitrite. Richard²⁵ has used amyl nitrite to study the effect it has upon bloodvessels, with the view of determining their degree of elasticity. The effect of amyl nitrite, on the vagus center, is inhibition, while stimulating the vasodilating fibers. Hence, the action of amyl nitrite is to show that the elasticity of the arteries is altered, and their ability to dilate as the effect of the drug wanes. Arteriosclerosis is indicated by a feeble vasodilating and lower pressure reaction, showing that the arteries are less elastic.

Vagotonia is demonstrated by amyl nitrite causing a drop in the blood-pressure of a less pronounced degree, and there is no secondary high rise in the blood-pressure, while the appearance of extra systoles

²¹ Abstract Journal of the American Medical Association, 1920, **74**, 1138.

²² Archives of Internal Medicine, January, 1921, p. 71.

²³ Ibid., June, 1919.

²⁴ Repertorio de Medicina Y Cirugia Bogota, 1921.

²⁵ Archives des Maladies du Coeur, etc., Paris, September 20, 1920, p. 416.

under the influence of amyl nitrite confirms anew the exaggerated excitation of the vagus.

Sympatheticotonia, the opposite effect of the drug, is noted. The accelerating reaction is exceptionally rapid and intense, the maximal and minimal blood-pressure findings show a prompt and deep drop, and after the effect of the drug passes off there is a characteristic high rise in blood-pressure.

Amyl nitrite inhalation furnishes interesting information as to the condition of the myocardium as demonstrated by tracings.

Amylene-hydrate Poisoning.—Jacobi and Speer²⁶ report a case of poisoning by this substance. Six grains of this drug had been prescribed to be given in an enema to an epileptic, aged twenty-two years, who did not respond to bromides or other remedies. The nurse by mistake gave the patient 35 cc instead of 6 grains, which was not discovered until twenty-four hours later. Edema and cardiac insufficiency were manifest. At the end of forty-two hours following the giving of the enema, the patient suffered a gastric hemorrhage amounting to 1 liter, coffee-ground in character. Six hours later the reflexes returned, and the intoxication was thought to have been overcome. However, seven hours later, death occurred accompanied by a rise in temperature.

Antigonococcal Serum.—Ivens,²⁷ encouraged by the results obtained during the war by the use of specific serums, determined one year ago to experiment with antigenococcal serum in the treatment of some cases of gonococcal infection coming under his care. He employed serum in about 30 cases, in 22 of which tubal infection was the most marked feature. Endocervicitis was present in 3, and in 3 cases of arthritis 1 had occurred during pregnancy, another in the puerperium.

He adopted three methods of application. In one series he gave the serum subcutaneously diluted in normal saline, usually in a dose of 20 cc, repeated at intervals of a couple of days, every three days, or occasionally a week, giving in all from 20 to 200 cc.

In another series, on the supposition that the toxin is not diffusible, he tried the intraperitoneal method. Where there were dripping pus tubes or a pyosalpinx, the tube was washed out with normal saline, after being, if necessary, opened up. Conservative surgery was adopted when possible, both tubes, or at any rate one, being left. With a syringe 20 cc of serum was injected into the tubes, sometimes into the ovary, and the residue left in the pouch of Douglas. The abdomen was then closed without drainage, and the Fowler position adopted. To avert anaphylactic shock, a subcutaneous or rectal saline was given simultaneously. This method, which was employed empirically during the war, has been shown by Richet to have a scientific basis—namely, that sodium chloride has a protecting action against the assaulting infection. Lumie and Chevrotier have recently shown that other sodium salts act as well.

Thirdly, in a few cases of endocervicitis with profuse leukorrhea he tried serum packs in the vagina, alternating daily with packs moistened

²⁶ Therapeutische Halbmonatshefte, August 15, 1920.

²⁷ British Medical Journal, January 15, 1921.

with equal parts of 10 per cent salt solution and 5 per cent carbolic acid. In 1 case 200 cc of serum were used, but his limited supply did not permit him to utilize this method as frequently as he wished. The after-history of these local cases has been peculiarly good—one has recently become pregnant; another, which had previous ineffective treatment extending over a couple of years, got quite well, all trace of gonococci disappearing.

In no case has he used serum intravenously, as it is the only method in which he has seen fatal anaphylactic shock supervene after the use of serum. With repeated doses there is little doubt that it is safest to use the fractional method, and not to allow more than seven or eight days to intervene between the first and second doses.

With two exceptions, all these patients were married women. Thirteen had no children, and 9 only one—a striking percentage of sterility. All but three were between twenty and thirty years of age.

Every effort was made to confirm the diagnosis by bacteriological findings. The history and physical signs were generally clear, and he has not included doubtful cases. The existence of purulent vaginitis and of ophthalmia neonatorum in the children was of diagnostic value. Of the 30 cases subcutaneous injections were used in 19, in 6 intratubal and peritoneal, in 3 vaginal packs, and in 2 cases of bartholinitis, serum dressings.

All his cases made a good immediate recovery. In nearly all, either by personal investigation or through their medical advisers, he has made himself acquainted with their after-histories, which have been on the whole extremely satisfactory. There have been 3 definite failures—1 an acute case, in which an insufficient quantity of serum was perhaps responsible, and 2 which relapsed after a period of some months' good health, and in which there was every possibility of reinfection. Further operation had to be undertaken in all 3 cases; otherwise the results have been good. In spite of their dislike of subcutaneous injections many of the women have said they were glad to have them, as they felt the benefit. In nearly every case relief of pain was a marked feature. Seen after varying intervals of months the patients described themselves as feeling splendid, being fit for anything, and able to do their own washing—in fact, they form a marked contrast to many other cases of gonorrhreal infection in which no serum has been given at operation, and in which the presence of peritoneal adhesions causes so much pain and disability. In 1 case pregnancy was apparently proceeding normally. Discharges had stopped, and it was difficult to collect enough for bacteriological examinations, all of which were negative.

Antimony.—Favorable reports from the use of salts of antimony in the treatment of tropical diseases continue to be made. Christopherson²⁸ reports that Leishmaniasis of the skin may be cured by the intravenous injection of antimony tartrate.

BILHARZIOSIS requires 20 to 30 grains of the same drug intravenously to bring about a cure. Sixty grains and perhaps more are neces-

²⁸ Lancet, London, March 12, 1932, p. 522.

sary to cure KALA-AZAR. Larger doses usually repeated are required for the cure of TRYMPANOSOMIASIS. Antimony tritrate (potassium or sodium), when given intravenously in appropriate dilution and administered with care, may be given in larger total doses than is usually supposed.

Cawston²⁹ reports that in LEPERS the beneficial effects are not confined to the colloidal preparation of antimony. To some lepers antimony was administered in the form of tartar emetic intravenously, others received the antimony in the form of wine of antimony in a cough mixture. The use of antimony appears to be indicated in "chest" cases. Great benefit has been obtained by 2 to 5 cc doses of a 2 per cent solution of tartar emetic given twice a week.

Cummings³⁰ reports excellent results in the treatment of ulcerating pudendal granuloma by the intramuscular injection of 3 grains of antimony tartrate every three days for twelve doses. By mouth, 27 to 30 grains were taken during the same time. He doubts whether much benefit can be attributed to the oral administration.

Low and Greg³¹ concluded from their studies that the use of antimony is not a specific for filariasis as it is for bilharzial infections.

Arsenic.—Caniston³² states, in the discussion of the exhibition and doses of arsenical preparations, other than in syphilis, that while arsenic can be introduced into the organism by mouth, subcutaneously or by rectum, he believes that mouth administration offers greater danger to intolerance than when given subcutaneously.

ARRHENAL (*Sodii metharsenas*) can be indifferently used either by mouth or subcutaneously, but the cacodylic products are always to be feared when given by mouth. Some observers believe that arsenic should only be given by subcutaneous administration, but this is not the majority view.

Solutions of arsenic given by the mouth should be properly diluted in an appropriate vehicle to diminish the irritating action of arsenic on the stomach. The gastric mucosa of elderly subjects is less tolerant to arsenic than that of children and adults. Arsenic preparations are to be given after meals.

Tolerance of Fowler's solution may be increased by the addition of some tincture of opium.

Arsenic can be used in pill form. Sodium cacodylate can be given by this method. To overcome objections to other routes of administration the rectal administration has been claimed by some as the one of choice. Highly diluted solution—as Fowler's solution, 5 cc, distilled water 60 cc— injected into the rectum three times daily. In this way a patient will absorb $\frac{1}{3}$ to 1 cg. of arsenous anhydride.

Proctitis and diarrhea may result from the rectal route of administration.

To Caniston it would appear that the hypodermic method is the only proper method if circumstances permit.

²⁹ British Medical Journal, March 19, 1921, p. 419.

³⁰ Ibid., March 20, 1920, p. 775.

³¹ Lancet, London, September 11, 1920.

³² Therapeutic Gazette, March, 1921.

Accidents due to intolerance are less, or at least trifling. The minor objection to hypodermic injection is pain and, at times, induration at the site of injection. Too strong a solution is usually the cause of the foregoing objection. It is unwise to give an arsenical preparation in greater concentration than 5 per cent. The site chosen had *preferably* be the muscles of the gluteal or hypogastric region.

Arsenical medication gives the best results by beginning with small doses and progressively increasing the size with intervals of rest to avoid immunity to the drug, acquired by long-continued use. Mineral compounds of arsenic are more toxic than organic.

A warning has been issued by the Public Health Service³³ against untried medicaments; with particular reference to the use of new arsenical preparations in the treatment of *syphilis*,³⁴ and editorially commented upon. The three arsenical salts referred to are: Arrhenal, the sodium salt of methyl arsenic acid and sodium salt of ethyl arsenic acid; monarsone and cacodylate of soda. Castilli showed several years ago that neither cacodylate of soda nor arrhenal had any action on experimental trypanosomiasis or spirochete infections. The fact that a drug has a high arsenic content with low toxicity cannot be used to prove that it has any definite increased value over the ordinary salts of arsenic in the treatment of syphilis.

Many organic compounds of arsenic as well as other drugs may cause temporary or apparent improvement in syphilis, but to date only those related to arsphenamine have proved of real value and comparatively safe.

In attempting to find the etiological factor producing scleroderma, Ayers³⁵ states that scleroderma and chronic arsenic poisoning possess many symptoms in common in individual cases. Three consecutive patients observed showed arsenic in the urine, and 2 gave a history of exposure to arsenic.

Traces of arsenic have been found in 43 per cent of a series of 48 specimens from sclerodermatous patients, which is of too low a percentage to be of any significance. Careful histories as to exposure to arsenic, detailed record, general symptomatology and arsenic tests in a large series of cases of scleroderma would determine whether arsenic plays a role in the etiology of this disease.

Arsphenamine.—Stokes³⁶ reports that, regarding the use of arsphenamine and related compounds, too short a time has elapsed since the discovery of these drugs and too little is known about the ultimate problems of syphilis to justify the announcing of new infallibilities. Seasoned tradition and conservatism are still the wisest grounds in our interpretation of clinical cure. Arsphenamine has made it apparently possible and even probable, but only to the inexperienced has cure been made absolute and inevitable.

In considering the question of poisoning by arsenobenzol compounds,

³³ Journal of the American Medical Association, June 12, 1920.

³⁴ Ibid., February 26, 1921.

³⁵ Archives Dermat. and Syph., December, 1920.

³⁶ Ibid., September, 1920.

Foulerton³⁷ states that three questions of practical importance bearing on this subject must be considered: (1) As to the general risk of poisoning in the treatment of syphilis; (2) whether other preparations substituted for the "606" of German manufacture has been in any way responsible for increasing the risk of poisoning; (3) whether the so-called intensive treatment with arsenobenzol compounds in combination with intramuscular injections of mercury, which came into vogue during the war, has had any influence in the frequency of the occurrence of poisoning. Taking a broad view of the matter in the light of our present experience, it has to be admitted that there is a definite risk in treatment with the arsenobenzol compounds. It is impossible to express in percentage the danger of the risk, but it is great enough to warrant keeping the individual receiving the treatment under observation for some weeks. Abstinence from alcohol and regulation of diet to lighten the work of the liver as much as possible is required. The diet should consist largely of carbohydrates, with very small quantities of lean meat or preferably fish—excluding the fatty kinds, such as herring, mackerel, etc.

Smith,³⁸ in pharmacological studies on arsphenamine, concludes that the rise in pulmonary pressure produced by intravenous injection of arsphenamine is shown to be obstruction. The cardiac dilatation following intravenous injection of arsphenamine does not appear to be one of the direct effects of the drug, but rather secondary to pulmonary obstruction causing right heart to work under undue strain, and secondary dilatation. The toxicity of various arsphenamine preparations, as determined by their circulatory effects in the dog, varies considerably.

Rockford-Baker highly recommended the use of arsphenamine dissolved in glycerin (a 10 per cent solution) in the treatment of Vincent's angina and infections in which the fusiform bacilli and spirochetes resembling Vincent organism are found.

Nichols,³⁹ in a study of the spirocheticidal value of monarsone (sodium ethyl arsenate) concluded that, from his experiments on rabbits infected with syphilis, no spirocheticidal power was manifest as the result of the use of monarsone. For its practical use in syphilis, there is no such germicidal basis as exists in the case of the arsphenamine group.

Atropine.—We have been taught, and from experience learned, that when the usual dose of atropine is given, we expect a quickening of the heart-rate. McGuigan,⁴⁰ in the study of the effects of small doses of atropine, even the pharmacopial dose $\frac{1}{20}$ grain, the only influence noted on the heart seems to be a slowing of the rate. Larger doses of atropine $\frac{1}{60}$ grain still causes slowing, with a tendency to irregularity. If the object is to paralyze the vagus endings and release the heart (presumably also to relax the smaller bronchioles), at least $\frac{1}{60}$ grain hypodermically is necessary. In urgent cases $\frac{1}{30}$ grain should be given.

³⁷ British Medical Journal, June 26, 1920.

³⁸ Journal of Pharmacology and Experimental Therapeutics, June, 1920.

³⁹ Journal of the American Medical Association, May 14, 1921.

⁴⁰ Ibid.

In the atropine treatment of the hypertonic state in infants, Kaiser⁴¹ states the method outlined by Haas gives the best results. A 1:1000 solution used, usually 1 drop or $\frac{1}{1000}$ grain in each feeding is the initial dose. The dose is increased to 2 drops for the next twenty-four hours if no contraindications are present. In order to produce the desired relief of symptoms, 3 or 4 drops six or seven times a day may be necessary. The average hypertonic infant will tolerate from $\frac{1}{50}$ to $\frac{1}{25}$ grain of atropine a day.

Jones⁴² reports ATROPISE POISONING in a number of school children who have had a 2 per cent solution of atropine instilled into the eye for refraction, in a mistake made by the druggist who supplied atropine instead of homatropine. His conclusions are that atropine as a drug for children is comparatively harmless, the average dose being $\frac{1}{200}$ grain, while 8 children received 5 drops of a 2 per cent solution ($\frac{1}{5}$ grain in all), about forty times the usual dose. In sending prescriptions for homatropine to any one but one's regular druggist, the word "hom" should be emphasized either by underlining, printing in red ink, or attention being called by a note on the bottom of the prescription.

Benzyl Alcohol.—Macht⁴³ finds that benzyl alcohol, either alone or as part of a mixture, consisting of equal parts of benzyl alcohol and chloroform furnishes a most efficient remedy for toothache. It is second to cocaine in its efficacy in relieving toothache, and, as it is the least toxic of all the well known anesthetics, the repeated and free use of this remedy is safe even in small children. The remedy is applied on a pledge of cotton which is inserted into the cavity or applied to the exposed nerve.

Benzyl Benzoate.—The success that Macht⁴⁴ has had IN THE TREATMENT OF THE HIGH BLOOD-PRESSURE, with the statement that he has found few cases which could not be relieved at least by benzyl benzoate, is most worthy of consideration. A number of the patients were ambulatory cases who attended to their daily occupation while taking the drug. In most of the patients the reduction of blood-pressure was accompanied by improvement in their general condition. Those with precordial pain or oppression were greatly relieved.

The method of administration found most effective was taking 20 to 30 drops of a 20 per cent alcohol solution of benzyl benzoate in cold water, three times a day after meals. After the therapeutic effect was obtained, smaller doses will maintain the effect.

Benzyl benzoate reduced blood-pressure even in cases in which the nitrites failed. The onset of the effects of benzyl benzoate is slower but of longer duration than the nitrites, with the probable exception of erythrol tetranitrite. No toxic effects from the drug have been noted, especially has it not aggravated old nephritis or produced nephritis. Anginal pains and precordial pains are greatly benefited by benzyl benzoate. Angina pectoris is benefited by treatment between attacks, but amyl nitrite is better during the attacks.

⁴¹ New York Medical Journal, December 18, 1920.

⁴² Journal of the American Medical Association, May 19, 1921.

⁴³ Ibid., October 30, 1920.

⁴⁴ New York Medical Journal, August 28, 1920.

Musser⁴⁵ reports giving benzyl benzoate religiously to 6 patients for weeks for hypertension with no effect, and likewise in discussing its use with his colleagues the general opinion was that they found it ineffective in the treatment of hypertension. He testified to its value in angina pectoris, 2 patients being greatly benefited by its administration.

Ruhräh,⁴⁶ in discussing the VALUE OF BENZYL BENZOATE, states that it may be used in place of atropine WHENEVER A RELAXATION IS DESIRED IN SPASM OF SMOOTH MUSCLE. General convulsions, not dependent on organic lesions of the central nervous system are benefited by this drug. Relief of spasm in WHOOPING-COUGH has been noted, although its action is as uncertain as other antispasmodics in this disease. He recommends its use in *bronchial asthma, spasmodic bronchitis, gastric or intestinal colic, hiccuph and spasmodic constipation.*

Macht⁴⁷ has obtained excellent results in the treatment by benzyl benzoate of *hiccuph of peripheral origin*. Inasmuch as benzyl benzoate acts chiefly on smooth-muscle structures when it is effective the hiccoughs are peripheral in origin. When ineffective, the hiccoughs are central in origin, thereby the drug assists in the differential diagnosis of the origin of the spasmodic contractions. The drug should be administered by taking 20 to 40 drops of a 20 per cent alcoholic solution in milk or water, as needed to control the condition.

Macht⁴⁸ believes, in a careful study of the effect of benzyl benzoate in *whooping-cough*, that, in combination with a little benzaldehyde, it is a valuable palliative remedy in pertussis—decreasing the violence and the frequency of the paroxysm.

Glenn⁴⁹ reports most remarkable effects from the use of *Benzyl Benzoate in The Treatment of Seasickness*, in which great relief was obtained by every one of 20 patients who used the drug. Ten drops was the dosage, although he believes one-half to one teaspoonful can be given with safety. A case of *Acute Balantidiosis* complicated by infections with hookworm and trichiura was treated by the use of benzyl benzoate under the direction of Haughweit.⁵⁰

The treatment was not started until the patient had had the disease for twenty-three days, at which time the patient was exhausted and, apparently, nearly dead.

Relief from gastro-intestinal symptoms, associated with diarrhea, was experienced in twenty-four hours. The parasites showed a tendency to diminish in numbers in the feces until the eighth day following the institution of treatment, when they suddenly appeared from the stool. He is inclined to regard this as the expression of a wholesale exodus of the ciliates from the tissues.

Blood (Citrated).—In the experience of Lapage,⁵¹ he obtains excellent results from the TREATMENT OF MELENA NEONATORUM BY THE INJECTION

⁴⁵ New York Medical Journal, October 16, 1920.

⁴⁶ American Journal Medical Sciences, January, 1921.

⁴⁷ Medical Record, July 24, 1920.

⁴⁸ John Hopkins Hospital Bulletin, July, 1920.

⁴⁹ California State Journal of Medicine, November, 1920.

⁵⁰ Philippine Journal of Science, June, 1920.

⁵¹ Proceedings of the Royal Society of Medicine, July, 1920.

OF FRESH CITRATED BLOOD. The first case he had was an infant blanched from a severe attack of melena neonatorum. Twenty cc of blood were taken from a house-officer in the hospital, mixing it with 7 grains of sodium citrate, and this was injected into the external jugular vein of the infant. The next day the melena had disappeared, and there was no recurrence. The coagulation time of this infant was tested and was found to be seventeen minutes before the injection, and three weeks after the injection it was found to be but nine minutes. He reports another successful application of this form of treatment by the injection of citrated blood in an infant, who was in a very critical condition as the result of melena neonatorum. Fifteen cc of citrated blood were injected with excellent results. The injection of citrated blood into an infant is by no means an easy operation, especially into the jugular vein and, in the future, Lapage states he will use the superior longitudinal sinus. He believes this method of treatment to be superior to the use of horse serum and gelatin. Other authors give fresh serum subcutaneously, 10 cc three times a day, as recommended by J. E. Welch. All of this he regards as inferior to the intravenous injection of fresh citrated blood.

Borax (*Sodium borate*), found in practically every household in the country, is used for household purposes and occasionally as a medicine. It is safe to say that the laity do not regard it as a poison, and, likewise, it is surprising to learn that it has produced a fatality by its ingestion. Potter⁵² reports a man, aged sixty-six years, who took by mistake for saline cathartic an ounce of borax. Within fifteen minutes he was seized by violent epigastric pain, accompanied by retching. Two hours later the patient's pulse became weak, the extremities were cold and clammy, there was a cold sweat on the forehead, and cyanosis was present. At five-minute intervals he suffered from severe choking sensations, and almost strangled when whisky was administered.

Active stimulation failed to relieve the patient, and death occurred three hours after taking the borax. Necropsy findings were practically negative except for demonstrating that the powder in the stomach was borax.

The absence of gross necropsy lesions agrees with the usual findings. Potter, in concluding, states that borax taken in relatively large quantities is a potent poison, and should be labelled poison, and should not be used carelessly without a definite understanding that it has fixed toxicological properties.

McCartney⁵³ reports excellent results from the use of baborate of soda in the treatment of *epilepsy*. The drug was tried on 60 cases of chronic epilepsy, who have been residents of an institution for a number of years. Before the baborate treatment was put into effect, it was customary to use potassium bromide in doses of 30 grains night and morning. Examination of the ward books shows that the drug had very little effect in reducing the number of fits or in bringing about any mental improvement. The only effect noticeable was a lessening of excitability and an increase of mental confusion.

⁵² Journal of the American Medical Association, February 5, 1921.

⁵³ British Medical Journal, October 9, 1920.

Eight months ago McCartney decided to try a mixture containing potassium bromide and sodium borate. At first the treatment was tried in one patient only, and the results were so striking that it was decided to try the treatment more widely. As a consequence of this treatment, the frequency of the fits were reduced by 64 per cent in four months, while for a period of six weeks in two other wards where the drug was used the frequency of the fits were reduced 68 per cent. Four patients have had fits since the institution of this form of treatment, previous to which 3 had fits at intervals of not more than eight days, and 1 went twelve days before having fits, then had about three to five. In all, this treatment has been tried on 42 patients. The mental state was improved in every one of these patients, and in all but one the number of fits have been reduced.

Botulism.—In the issue of PROGRESSIVE MEDICINE, December, 1920, I described in detail the rather widespread poisoning reported as the result of *Bacillus botulinus*. It will be remembered that the first cases reported were in those people who ate ripe olives contaminated by this bacillus; later on, it was reported as the result of poisoning from canned food, usually in "home-canned."

As far as it is known, the bacilli are present in the community at the time of canning and by this means get into canned products. Ripe olives have attracted most attention as a carrier and it has not been, so far as is known, found in unripe olives, no doubt due to the prolonged process they are put through during the canning process, which destroys the organism. It is difficult, in most instances (except the odor of putrefaction be present), to detect by appearances that the food is contaminated. The symptoms usually appear very promptly following the ingestion of the infected food. They have been noted as early as two or three hours and have been delayed for forty-eight hours. There are difficulty in swallowing, interference with speech and ocular symptoms as outstanding manifestation of poisoning. Later, gastro-intestinal symptoms, the symptom complex fever and gradual oncoming weakness, exhaustion and coma.

The treatment is a subject which received much attention and thought during the past year. Considerable experimental work was done on laboratory animals by Burke,⁵⁴ Elder and Pischel. The results of this work, as well as the observation of the treatment given human cases of botulism, indicates that there has not been sufficient knowledge gained to develop a scientific treatment. Too short a time has elapsed for the development of treatment which will meet the requirements of rendering so rapidly acting and violent a poison non-effective.

The treatment may be arbitrarily divided into specific and general measures. Under the specific treatment, a polyvalent serum must be developed which will neutralize the toxins of which we know there are two distinct types and this serum should be bactericidal as well as anti-toxic. Inasmuch as the toxin is rapidly-acting, it must be given early by the intravenous route in all suspected cases before symptoms set in

⁵⁴ Archives of Internal Medicine, March, 1921.

and to neutralize as promptly as possible the toxin after symptoms have appeared. It will not do good in already damaged tissue.

These experimenters have sufficient evidence to believe that some of those receiving lethal doses of toxin can be saved by the use of anti-toxin if the treatment is begun at about, or before, the time of the appearance of symptoms.

The general or symptomatic treatment deals with the management of the symptoms referable to the gastro-intestinal tract and to stimulation of the nervous system.

The gastric juice has no effect, so far as is known, upon the toxin of *Bacillus botulinus*, thereby differing from the toxin of *Bacillus diphtheria* and *Bacillus tetanus* and affording an opportunity to develop a treatment directed against the toxin in the digestive tract as well as in the blood.

STOMACH.—As in most poisonings, the earlier the stomach can be washed out (and the procedure is usually repeated), the more is to be expected from the treatment. When the effects of the poisoning appear early, the toxin is usually found in the stomach. Paralysis of the stomach apparently sets in early. The removal of the stomach contents is not without its dangers because of the possibility of inducing pneumonia. Paralysis of the throat renders the individual liable to contracting pneumonia.

INTESTINAL TRACT.—Until we know whether or not the toxin is harmful in the intestinal tract, we must take steps for its removal, neutralization and the prevention of absorption. The same investigators recommend the use of high enema that will neutralize the toxin, prevent its absorption and destroy the organism. Liquid soap neutralizes the toxin, olive oil prevents its absorption and turpentine may have some beneficial action. Iodine and potassium permanganate destroy both toxin and organism, and might be used to advantage.

THROAT.—A non-irritating gargle of 2 per cent solution of argyrol may be used when paralysis of the throat threatens or actually is present, as a precautionary measure to contracting pneumonia.

Pilocarpine has been used to remove the tenacious mucus in the throat in advanced cases.

NERVOUS SYSTEM.—Strychnine has been used in most cases. In spite of the treatment, the death-rate varies from 60 to 70 per cent throughout the country. Those patients showing symptoms early have mortality of about 90 per cent, and among those showing late, 60 per cent.

Bromo-seltzer.—This preparation is a patent medicine extensively and indiscriminately used in the treatment of *headaches* by the laity. Its action unquestionably is due to the 20 grains of acetanilide to the ounce which it contains, as stated upon the label. McEllroy⁵⁵ reports a male patient, aged thirty-six years, suffering from the effects of taking bromo-seltzer since 1911, beginning its use in quantities of approximately 5 ounces during every three or four days. Except for the year 1912, when the patient took sal hepatica, the patient has gradually increased

the quantity of bromo-seltzer taken until April 20, 1919, the patient took four to five one-ounce bottles daily. The bromo-seltzer had been taken for "stomach trouble" associated with headache. On April 23, 1919, the patient was admitted to a hospital complaining of nervousness, severe frontal headache, dizziness and shortness of breath. From April 27 to May 26, he was delirious, and physical restraint was necessary. Treatment consisted of sedatives, elimination and iron, and on June 25, the patient left the hospital in a good physical and mental condition.

The outstanding features of the toxic effects were a persistent met-hemoglobinemia, associated with cyanosis and mental derangement.

Caffeine.—Hare,⁵⁶ in discussing cardiac therapy in the course of infectious diseases, believes that the medical profession pays too little attention to the value of caffeine as a circulatory stimulant and respiratory stimulant when stimulation is needed during the course of the acute infections. Not only is caffeine too infrequently used, but, when it is used, the dosage is too small. According to French and Russian medical literature, the drug is used in from 15 to 20 grains in a twenty-four-hour period. Hare believes that 2, 3 or 4 grains of the alkaloid caffeine should be used three times a day. Citrated caffeine, in which form the drug is often prescribed, is a mechanical mixture which contains 50 per cent of caffeine, therefore, if this kind of medication is used, the dose must be doubled. The author believes that digitalis is too generally used during acute infectious diseases when not indicated, and cautions that any remedy is just as potent for evil as potent for good. Caffeine has no cumulative effect as has digitalis, and will often act better than this drug in increasing the functional activity of the kidneys in the elimination of toxic material. Any tendency to nervous irritation from caffeine may be controlled by sodium bromide or, if necessary, by the administration of morphine or codeine at night.

Heatcote⁵⁷ has concluded that, as the result of experimentation,—caffeine has an active vasodilator action on the coronary vessels, probably muscular in origin. The evidence is that caffeine may be useful because of its vasodilator effect in angina pectoris.

Camphor.—Zehner⁵⁸ calls attention to the use of small doses of camphor, frequently repeated, for correcting circulatory disturbances and mobilizing substances favoring coagulation, and thus tends to arrest hemoptysis due to congestion. Camphor acts by its vasoconstricting properties, and, therefore, in hemoptysis from ulceration, must be given in large doses. Cheinisse warns against the indiscriminate and prolonged use of camphor as entailing untoward consequences.

Carminatives.—Without any very definite explanation of how they do good, carminatives enjoy a wide use in giving relief to a number of gastro-intestinal complaints. Volatile oils are drugs containing these properties and are used as carminatives. Plant⁵⁹ applied volatile oils

⁵⁶ Therapeutic Gazette, December, 1920.

⁵⁷ Journal of Pharmacology and Experimental Therapeutics, December, 1920.

⁵⁸ Presse Médicale, September 11, 1920.

⁵⁹ Journal of Pharmacology and Experimental Therapeutics, November, 1921,

in therapeutic doses locally to the mucous membrane of surgically isolated intestinal loops of dogs and the peristaltic movements were recorded.

The records thus obtained demonstrated that the volatile oils increased the muscular activity of the intestine by augmenting the tone and rhythmic contractions. Occasionally, the movements were followed by relaxed conditions. Atropine will lessen, but not abolish, the effects of these carminative oils. Plant has classified these carminatives into two groups. The more potent representatives are volatile oil of mustard, cinnamon, peppermint, cloves, nutmeg, spearmint, juniper, lavender, as well as menthol and camphor. The less potent group includes oils of anise, cardamon, orange, fennel and caraway.

Cascara Sagrada.—This drug is so generally used that McGuigan⁶⁰ believes that it is very important to call the attention of the medical profession to the fact that it is not as ideal a drug, or that it is not as fool-proof as it is generally believed to be. Text-books recommend the substance as a bitter and a stomachic, that it improves digestion, is a tonic for digestion, that susceptibility to it is not lost by long use; it does not produce constipation, and, on the contrary, the establishment of regular habits permits its gradual withdrawal.

It has also been lauded as a cholagogue and for a host of conditions of the gastro-intestinal canal.

Recently, McGuigan made a number of experiments (more than twenty) on medical students and assistants which he believes worthy of record.

One cc will cause a laxative effect, usually one movement of the bowels, in from eight to twelve hours. There is little, if any, griping in these cases. Occasionally this amount of the drug is without noticeable effect.

Two cc will cause two movements of the bowels in from five to twelve hours. There is usually considerable griping from this dose, which begins in about four hours and may last twenty-four hours.

Four cc causes three or four movements of the bowels, also accompanied with painful griping and some nausea. This griping may persist for two or three days, and the abdomen is somewhat tender; there is a desire to go to stool when no necessity exists. An indefinite uncomfortableness persists for several days.

He believes that when more than 2 cc is needed for effect, some other drug is indicated. As a result of his experiments, he believes, with Hare,⁶¹ that more than 2 cc of the fluidextract often produces irritation of the bowel, enteritis and intestinal catarrh. Cascara should never be used as a cathartic, and its only field is as a laxative. Small doses several times a day seem to give better results than the sum of these doses given in a single dose.

There are no doubt inferior preparations of cascara on the market, and at times other bitter substances are added to cascara, aloes for

⁶⁰ Journal of the American Medical Association, February 19, 1921.

⁶¹ Hare Practical Therapeutics, 1920, ed. 18.

instance, which may account for the need of larger doses than 2 cc to get an effect.

Chaulmoogra Oil.—Experiments conducted by McDonald and Dean⁶² indicates that this oil has a therapeutic effect in the treatment of *leprosy*, because of one or more substances it contains. They found that the intramuscular injection of the soluble ethyl esters of the fatty acids resulted in prompt improvement in the clinical symptoms. Although conclusive evidence is not at hand, it is probable that the injections of the esters of chaulmoogra oil are far more efficacious than the oral administration of the oil. Although it is too early to be absolutely sure of the permanent cure by this oil, nevertheless it is assuredly so that it is a most valuable agent in the control of the disease.

McDonald⁶³ treated leprosy, at the Kalihi Hospital, Hawaii, in 87 cases, with apparent cure, as follows: Weekly intramuscular injection continues to be the standard treatment. Ethyl esters of the entire fatty acids of the whole oil with 2 per cent of iodine by weight chemically combined, the dosage of which begins with 1 cc at every second or third injection until they reach from 2 to 6 cc, according to the age and weight of the patient. Internally, patients receive in capsule form the mixed fatty acids carrying 2.5 per cent iodine in chemical combination; the fatty acids, rather than their ethyl esters, because they better conform to the normal digestive process which precedes fat absorption; they are, therefore, using by mouth a predigested oil or fat which is semisolid at room temperature, and, in capsule, very easy to take. Its dosage begins with $\frac{1}{6}$ gm. per 100 pounds of the patient's weight, three times a day, an hour or two after meals. This is gradually increased every two weeks until the maximum of 1 gm. per 100 pounds of weight per dose is reached. Of these two forms of administration, they have gradually come to regard the injection as the vastly more important of the two. In fact, they had 10 patients on injections alone for several months, and they seemed to do as well as those who took both injections and capsules. It should be said for the fatty acids, however, that they consider them the most efficient form of the oil ever devised for internal use. For weeks at a time no single complaint of digestive disturbance is received. They are sometimes asked why the iodine is added, but confess that they find themselves unable to furnish an especially substantial defensive reason. It was used by their predecessors here, as also by others elsewhere, and was considered decided beneficial; it has an old and respectable reputation for effecting catabolic or retrograde metabolism, with a tendency to promote in the economy the absorption of inflammatory and hyperplastic products. Then, too, the fatty acids of chaulmoogra oil are unsaturated acids, and therefore capable of taking up iodine to form chemical compounds having none of the irritating properties of free iodine. And yet they suspect they could well do without it.

A valuable and timely contribution to the chemotherapeutics of chaulmoogra oil is that of Walker and Sweeney, of Hooper Foundation,

⁶² Public Health Report, August 20, 1920, **35**, 1959.

⁶³ Journal of the American Medical Association, November 27, 1920, p. 483.

proving conclusively what was foreshadowed by Dean, that the bacterial agent, a hundred times more active than phenol (carbolic acid) in the effective destruction of the lepra bacillus, is no other than that same unique five carbon ring molecule in the structure of the chaulmoogra acid series. Thus have those skilled investigators absolutely proved by laboratory methods *in vitro* what McDonald has been empirically demonstrating *in vivo* at this station for the last two years with the Dean derivatives.

Preparatory to injections, syringes, needles, etc., are sterilized for from thirty minutes to one hour, 15 pounds of steam in the autoclave. The site chosen is the upper and outer quadrant of the gluteal region, and a spot for the puncture is painted with tincture of iodine. They employ a 20 cc all-glass Paris syringe and ordinary antitoxin needles, one for each patient, inserted its full length to reach the musculature. While there have been reported from other sources rather frequent abscess formation as derogatory to intramuscular injection, in 6924 deep injections administered from October 1, 1918, to the present time, he has had but 1 case of resulting abscess.

Chelidonium.—In recent years the use of a number of drugs have been entirely discontinued for one reason or another, usually because of the lack of results on account of not fully understanding the pharmacology of the drug, or because it has been prescribed for too wide a range of diseased conditions. With the excellent work being conducted in the well-equipped pharmacological laboratories of this country, I have no doubt that many ideas that we now have regarding a number of drugs will be materially changed—some for the better, others for the worse. Hanzlik,⁶⁴ in a study of chelidonium, an active principle of chelidonium, states that he is of the opinion, because of his experiments, that this substance has been very much neglected. The action of chelidonium is comparable to that of papaverin and benzyl esters, and possesses a relatively low toxicity.

Chelidonium differs in its action from morphine by causing depression and narcosis without subsequent excitation of the central nervous system. The blood-pressure is lowered; the pulse-rate is slowed because of the depressing action it exerts on the myocardium. Smooth muscle is relaxed in all regions, and skeletal muscle depressed without influencing nervous connections.

The indications for the use of chelidonium are *hypertonus angina pectoris bronchial asthma* and *colicky pains*. It is more palatable than the benzyl esters.

Chenopodium.—In the treatment of various parasitic diseases, numerous observers have reported their results as have been described in PROGRESSIVE MEDICINE for December, 1919, and December, 1920. Darling,⁶⁵ *et al.*, have had excellent results, which were carefully checked to note the effectiveness of this remedy in the treatment of *hookworm* disease. The failure to secure uniform results in the use of this remedy for the treatment of hookworm disease led these workers to conduct

⁶⁴ Journal of the American Medical Association, November 13, 1920.

⁶⁵ Ibid., February 12, 1921, p. 419.

experiments to determine the best technic for the administration of the drug. The following factors were considered in connection with the administration of the drug: (1) The influence of the preliminary purge; (2) the influence of the preliminary starvation period; and (3) the influence of food.

The maximum dose of chenopodium oil is 3 cc for adults, but more commonly 1.5 cc is given, with graded doses for children according to age.

Darling, Hartman and Hacker⁶⁶ found that the dose of chenopodium should be divided into two equal parts, given two hours apart in freshly prepared hard gelatin capsules; the last capsule is followed in two hours by a purge.

Theoretically, it would seem that the drug would be more effective with a preliminary purge and a preliminary starvation, but, as so frequently happens, what would appear to be most rational are not proven to be the facts if an attempt is made to prove the result.

Darling and his co-workers found that a preliminary purge does not add to the efficiency of the treatment with chenopodium.

When the drug was given in two doses, 1.5 cc being considered the adult dose, the preliminary starvation period was found not necessary in the treatment of hookworm disease; on the contrary, the efficiency of the chenopodium was lessened. The taking of food in small quantities coincidently with the drug, when the chenopodium is given in divided doses of 1.5 cc, greatly diminished the efficiency of the drug in the treatment of the disease. That the decrease in the efficiency of the drug is noticed to a greater extent in children than in adults if the preliminary purge and starvation periods are practised.

Chloral.—In connection with poisoning, especially of unknown origin, an examination of the pupils is made for the help it may be in coming to a decision as to the identity of the poison. Hyatt, McGuigan and Rettig⁶⁷ report that the statements made in regard to the condition of the pupils in chloral poisoning are contradictory. The pupil in the human, when 1 grain of chloral is used, inducing sleep, is slightly contracted. These workers have shown that experimental evidence to be central in origin and due to removal of inhibition influences which are active. Strychnine, caffeine, atropine and other drugs, acting centrally, are, therefore, indicated in the treatment of chloral poisoning because of their antagonistic action.

The experience of Glaus⁶⁸ is that chloral, in doses of 1 to 2.5 gm. is most valuable in combating insomnia in patients with heart or vascular disease, especially with high blood-pressure. In such cases, most remedies fail, except opium. The sedative action of chloral is supplemented by its diuretic and vasodilating action. Patients may take the drug for years. When given over a period, it is given preferably in a starch enema. By mouth, it is best given dissolved in 20 gm. of water and 10 gm. of syrup of orange. Severe cases of cardiac

⁶⁶ Hookworm and Malaria Research, Pub. 9 International Health Board, 1920.

⁶⁷ Journal of Pharmacology and Experimental Therapeutics, November, 1920.

⁶⁸ Ibid., July, 1920.

insufficiency contraindicates its use. The use of chloral caused some patients, who had a daily output of less than 700 cc of urine under digitalis, to put out 1400 to 1600 cc of urine.

Chlorine.—Halldorson⁶⁹ is most enthusiastic about the results he has obtained in the TREATMENT OF DISEASES OF THE RESPIRATORY TRACT BY THE USE OF CHLORINE. He also regrets that although he has written about the treatment heretofore⁷⁰ it appears to him that after it was read it was promptly forgotten. The author of this treatment states that since November 1, 1918, he has treated 185 cases of pneumonia by this method and has had but 8 deaths, or a mortality of 4.9 per cent. This treatment has been used in a series of 257 cases, 72 having been reported previously, with 1 death, giving a death-rate of 3.5 per cent, 4.9 per cent. of influenzal pneumonia and 1.4 per cent for lobar pneumonia.

Since August, 1906, he has used CHLORINE FOR TUBERCULOUS INFECTION on, all told, about 400 cases with such gratifying results; he considers the use of chlorine in tuberculosis no longer an experiment but an established treatment. The writer states, of course, that he does not neglect the other measures in the treatment of pneumonia and tuberculosis.

The author concludes that the drug must be given as described herein, and then, if used according to his directions, chlorine is one of the most useful drugs in the treatment of all medical diseases of the respiratory tract.

There is but one form of chlorine that can be used in medicine (outside of inhaling the gas, which he has never found of much use); this is the watery solution. He has been using a solution made as follows:

Sod. chlorate	gr. xl
Acid. hydrochlor	fʒij
Aqua destillate	fʒxvj

Place the sodium chlorate, freshly ground, in a quart bottle preferably with a glass stopper, add to this the hydrochloric acid, and let stand without heating for a minute or two until the salt is fairly well dissolved; then remove the stopper carefully and, at arm's length, add about 1 ounce of water. Now shake vigorously. Keep on alternately adding water and shaking until there are 16 ounces in bottle.

When large quantities are needed, chlorine solution may be made by charging distilled water from gas cylinders, but, for smaller quantities, the above method will answer the purpose.

If properly made, chlorine solution should have a rich olive-green color and strong chlorine odor. Care must be taken that the chemicals combine properly or the solution will contain free hydrochloric acid, giving an unpleasant acid taste to the mixture. Whenever chlorine solution is used in a mixture it should be put in last, the other ingredients being well shaken up before it is added.

Chlorine solution may be given in doses of two to four teaspoonfuls

⁶⁹ Therapeutic Gazette, November, 1920.

⁷⁰ Ibid., February 15, 1919.

in a tumblerful of milk or buttermilk as often as indicated. It is the best form to use in acute tuberculosis, but, on account of its disagreeable taste and odor, it ordinarily has to be combined with a vehicle of some kind. Because of its extreme activity, very few substances will combine with it properly. As a matter of fact, the only satisfactory vehicles he has found so far are lighter extracts of cod-liver oil, especially Parke Davis & Co. (palatol) or Frosst, of Montreal (Elix. Gaduine Comp.). The heavier extracts throw down a precipitate when combined with chlorine solution, and so do all other substances he has so far tried. He uses the name "Palatol" or "Elix. Gad. Co." so that there can be no mistake about what is meant. Formerly he would simply put down "Elix. Ol. Morrh.," and some druggists instead used the extract of cod-liver oil, which with chlorine makes a most horrible mixture, unpalatable and indigestible. For this reason he now writes the prescription as follows:

R—Sol. chlori.
Palatol or Elix. Gaduinæ, $\frac{aa}{aa}$
Sig.—Dose as given below.

Nearly every druggist when given this prescription will have to be taught how to put it up, and usually will have to be watched until he has become fairly well accustomed to compounding it. In preparing chlorine solution, either sodium or potassium chlorate may be used, but the sodium salt seems to dissolve better with hydrochloric acid and to make a better solution.

The dose in pneumonia is $\frac{1}{2}$ ounce of the above mixture every three hours until crisis comes. Then it may be given before meals and at bed-time as long as it seems to be agreeing with the patient, or as long as the attending physician deems its use necessary. To children, under six years of age, a teaspoonful may be given; and to those between six and twelve years, two teaspoonsfuls. Larger doses produce no ill-effects. He has seen a two-year old child drink as much as 4 ounces of the mixture with impunity, but larger doses than here given are apt to produce stomach irritation, with loss of appetite, when long continued, which disappear as soon as the drug is discontinued.

In acute tuberculosis and influenza, the dose is the same as in pneumonia. In chronic tuberculosis, a tablespoonful of the same mixture may be given before meals and at bed-time, and this kept up as long as the patient's appetite remains good, or until stomach irritation is produced, when it may be discontinued for a week or so and then given in somewhat smaller doses. In very mild cases the quality of chlorine solution may be reduced to 3 ounces to 5 of the vehicle. Thin people, unless they are putting on weight, will have to be watched very closely. The hyperacidity will promptly disappear if alkaline salts, as sodium bicarbonate, are given.

Chloroform.—One of the results of the administration of chloroform as an anesthetic, especially in rather heavy doses, is the fall of blood-pressure and the concomitant weakness of the heart. Adrenalin, which is a very prompt and efficient drug to restore the arterial pressure and

stimulate the heart, has been suggested as a remedy in the condition, but Heinekamp⁷¹ warns against the joint action of adrenalin and chloroform as one which may more than likely result very disastrously, the adrenalin, by increasing peripheral blood-pressure, may cause a high aortic pressure and the weakened myocardium may fail to properly empty itself, resulting in dilatation or fibrillation. Chloroform should not be used when adrenalin is used.

Cinchophen and Neocinchophen.—These drugs have been on the market under the proprietary names of atophan and novatophan respectively, and have been widely heralded as superior substitutes for salicylates in the treatment of rheumatic fever. Hanzlik,⁷² *et al.*, as the result of experiment with these drugs, as well as with novaspirin, reported the following findings:

1. Cinchophen gave partial relief from symptoms in rheumatic fever with doses of from 3 to 6 gm., and complete relief with doses of from 10 to 13 gm. (7 patients), while neocinchophen required a somewhat higher range of dosage, namely, from 3 to 8 gm. for partial, and from 11 to 16 gm. for complete relief (3 patients).

2. Novaspirin was therapeutically worthless in the treatment of rheumatic fever (3 patients), not giving even partial relief from subjective symptoms. This is due to inadequate concentration of salicyl in the tissues, as indicated by the low (from 14.8 to 23.4 per cent), excretion of salicyl in the urine after large doses of the drug.

3. Large doses of cinchophen and neocinchophen, such as are necessary in the treatment of rheumatic fever, produce characteristic symptoms of salicylism ("toxicity") which, however, are less pronounced than those caused by corresponding doses of salicylate. Cinchophen differs from salicylate by causing epigastric pain, owing, presumably, to local irritation by the drug. Pain in the epigastrium was absent after large doses of neocinchophen, presumably because of its relatively low solubility in water and weak alkalis, possibly also because it is an ester.

4. Large doses of cinchophen were found to slow the pulse-rate of both febrile and afebrile individuals, and the same occurred after the neocinchophen in febrile patients. Therefore, the cardiac slowing produced by cinchophen is due to a direct depressant action on the circulation.

5. Cinchophen is injurious to the kidneys, as indicated by the occurrence of albuminuria, and sometimes by casts and white blood corpuscles, in the majority of 7 individuals these were observed, and a diminution in the excretion of phenolsulphonephthalein in the 5 individuals that were studied. Neocinchophen is variable, albuminuria, and a diminution of the excretion of phenolsulphonephthalein occurring in about one-half of the 9 individuals that were observed.

6. As compared with salicylate, cinchophen appears to be about equally efficient, while neocinchophen is somewhat less efficient, as judged by the dosage necessary for therapeutic relief in rheumatic fever. The symptoms of "toxicity" are about the same and renal injury

⁷¹ Journal of Pharmacology and Experimental Therapeutics, November, 1920.

⁷² Journal of the American Medical Association, June 18, 1921.

somewhat less after cinchophen, and both the "toxicity" and the renal injury are less pronounced after neocinchophen than after salicylate in corresponding doses.

7. Further observations on the therapeutic use of cinchophen and neocinchophen in rheumatic fever, and a study of their pharmacological actions, are desirable.

Cod-liver Oil.—The importance of vitamines in the dietary of the human individual has been demonstrated. Cod-liver oil has been shown by Osborne and Mendel⁷³ to contain a liberal portion of vitamine-A, frequently described as the fat-soluble food accessory. The importance of vitamine-A for the nutritive well-being in the young has been absolutely verified.

Zilva and Miura⁷⁴ have, by the biological method of animal-feeding tests, proved that crude cod-liver oil may contain two hundred and fifty times as much vitamine-A value as butter. A sample of refined cod-liver oil, though richer than butter, is less active than crude cod-liver oil in vitamine-A potency.

These gentlemen believe, to which I subscribe, that there is great danger in accepting the substitute products prepared by the drug firms for cod-liver oil, which contains little characteristic taste and appears almost colorless. In order to achieve this result, means may often be used which will certainly lessen, if not actually destroy, all vitamine-A potency.

Shipley⁷⁵ and his co-workers have discovered that cod-liver oil was most successful in the treatment of EXPERIMENTAL RACHITIS, by causing the deposition of calcium in the same fashion by which deposition occurs in spontaneous healing in man. They have also noted that, without increasing the calcium intake, cod-liver oil of itself initiated the deposition of calcium in the cartilages.

Although cod-liver oil has long been used in the treatment of various diseased conditions with good results, the tendency has been to regard it as a food. Aside from its food value, it seems that experiments will prove it to exert a most beneficial drug action and doubtlessly emphasize its use.

In pediatric practice, cod-liver oil has always been a very reliable drug for many conditions. As a food it has likewise had its value, and, aside from its disagreeable taste, to which most patients become accustomed more or less readily, it deserves more general use than it receives.

Rickets is a disease which has had a large number of hypotheses as to its causative factor. Park and Shipley⁷⁶ have recently shown, by their investigation, that cod-liver oil exerts some effect whereby calcium is deposited more readily by its administration than without. The experiments were conducted on rats suffering from experimental rickets. It was further noticed that the calcium is deposited in the same fashion as it occurs in the deposition during healing of rickets spontaneously in man.

⁷³ Journal of Biological Chemistry, April, 1914, **17**, 401.

⁷⁴ Lancet, 1921, **1**, 323.

⁷⁵ Journal of Biological Chemistry, January, 1921, **45**, 2.

⁷⁶ Ibid., 343.

Some of the older physicians used cod-liver oil with great success in the treatment of pulmonary tuberculosis, believing that it exerted a specific effect upon the tuberculous lesions. With the advent of the discovery of the tubercle bacillus, the bacteriologist scorned the idea that cod-liver oil could be of any value except as a food in the treatment of tuberculosis. Any person who believed to the contrary was not modern in his conception of the use of the drug. J. C. McWalter⁷⁷ points out that Sir Leonard Rogers and others, experimenting on certain oils as regards their influence on cancer, have demonstrated that cod-liver oil has a specific effect on the tubercle and on other acid-fast bacilli like those in leprosy.

This observation, with the experimental work in rachitis, suggests that some substance in cod-liver oil exerts an effect which retains calcium in the body which, in addition to its food value, adds to the fortifying action of the body against disease.

Corpus Luteum—Hoppe⁷⁸ believes, from an experience with the use of corpus luteum in the treatment of *hyperthyroidism*, that he has a drug whose action is comparable to that of thyroid extract in the treatment of myxedema. His experience extends over a period of six years. Fifty cases received this treatment, and the diagnosis was only made after he determined that a bruit was present in the thyroid gland. While Hoppe believes that corpus luteum is a specific agent in hyperthyroidism, he has not discontinued the symptomatic treatment, nor has he failed to institute proper diet and hygiene. On account of the general nervous and mental irritability, cases of Graves's disease are not easy to manage, nor do they faithfully carry out treatment, unless they are closely supervised.

Rest in bed, with 2 grains of corpus luteum, 3 grains of hydrobromate of quinine, and $\frac{1}{10}$ grain of extract of belladonna after each meal constitutes his more or less routine treatment. After the patient shows improvement, he reduces the dose to two a day, and even when the patient is apparently well one dose is given each day.

Patients who did not take the medicine as prescribed failed to get the results, or relapsed. He believes that hyperthyroidism and hypoövarism are synonymous conditions; that the interstitial glands and sex glands have an inhibitory action which regulates the secretion of the thyroid; that when the secretion of these interstitial glands is altered in quality or lessened in amount, there is a lack of physiological inhibition of the thyroid, with an excessive secretion and therefore hyperthyroidism.

In 1915, Hirst⁷⁹ began the use of corpus luteum extract by hypodermic injection in the treatment of the *nausea of pregnancy*, based on the theory that every woman, during the period of sexual activity, is constantly absorbing corpus luteum. Corpus luteum is marketed in the following forms: (1) Compressed tablets, containing about 5 grains of the dried substance; (2) powdered extract; (3) ampoules for hypodermic administration, containing 0.2 gm. of the dried substance in solution

⁷⁷ Letter to Medical Press and Circular, September 8, 1920.

⁷⁸ Ohio State Medical Journal, October, 1920.

⁷⁹ Journal of the American Medical Association, March 19, 1921.

in 1 cc of physiological sodium chloride solution. Hirst does not obtain good results when dried substance is given by mouth. Subcutaneous injection is to be condemned, because of the local reaction which is usually very severe in the case of an animal extract so given.

Deep intramuscular injection, next to the intravenous method, is to be preferred. The best results have been obtained when the needle is held perpendicular to the skin surface and given deeply into the muscle.

The ideal method, Hirst believes, is the intravenous injection, because it acts quickly, it is possible to give larger doses, and there is no local reaction or any discomfort after the injection. Intravenous injection controls the vomiting promptly when the intramuscular injection failed. The dosage in ambulatory cases is usually 2 cc every other day, more severe cases receive 2 cc daily. In pernicious cases, 2 cc is given twice daily. It seems that all patients should receive no less than twelve doses, regardless of the severity of the condition. If fewer are used, relapses are common, and are more difficult to control than the original condition.

Reactions need not be feared. In many hundred injections by Hirst and his assistants there was only 1 case and this was doubtful as to the presence of anaphylactic shock. It occurred in a neurotic patient. Since Hirst made this report, he states that another patient showed evidence of slight shock, with vaginal bleeding following which the patient aborted within twenty-four hours after receiving the injection. Goiter in early pregnancy absolutely contraindicates the administration of extract of corpus luteum, either intramuscularly or intravenously for the control of vomiting of pregnancy.

Cresol.—In discussing the system of disinfection of the German Army front during the World War, Beveridge⁸⁰ states that, of the chemical disinfectants used, cresol probably is the most valuable, not only for its disinfectant properties, but likewise it is a deodorant, will kill flies, and in hot solution destroy lice and their larvæ. Major Wynne found an emulsion of 1:100,000 was effective and imparted no objectionable taste to the water. It has been recommended for bilharzia-infected waters.

Diet.—**ANTISCORBUTICS.**—It is so frequently necessary to resort to the use of artificial feeding of infants with various preparations of milk that it becomes necessary, in view of the necessity of vitamines, to know what effect the process used in the preparation of milk may have on the vitamines and the antiscorbutic properties of the milk. Hart, *et al.*, investigated milk powders made by the Merrell-Soule process, the California Central Creameries spray process and the Just process. He found that the quantity of vitamine in the original milk was influenced by the feed, also that the spray process of the manufacture was more destructive to the vitamine than the Just process. This observation, he states, should in no way condemn milk powder made by the spray process, and simply indicates their limitations when used as a sole source of nutrients in infant-feeding. Probably all artificial means of

⁸⁰ Lancet, London, October, 1920.

feeding should be accompanied, or supplemented, by some potent source of antiscorbutic vitamine.

Ellis⁸¹ and his co-workers, in an attempt to determine factors which destroy or lessen materially the quantity and quality of antiscorbutic vitamines, found that cabbage desiccated in an atmosphere of carbon dioxide for thirty-five hours at 65° C. did not prevent the destruction of the antiscorbutic vitamine. On the other hand, fermentation, as in the making of saurkraut from cabbage and silage from corn, resulted in a destruction of the antiscorbutic factor.

As an antiscorbutic, Gerstenberger⁸² reports that a rapid and marked cure, such as experienced from orange juice, of 3 cases of severe infantile scurvy by the administration of 100 gm. of malt soup extract. He believes that the presence of the antiscorbutic properties in this lot of malt soup used was due to the fact that it was in all probability made from barley of the proper age and state of germination, or from a lot of barley possessing an unusually high degree of potential antiscorbutic material.

Attention has been called in an editorial⁸³ to the variations in the antiscorbutic potency of milk. Although, until the recent discovery of the vitamine-content thereof, milk was first studied from the point of view of its carbohydrate, protein and fat content, and subsequently the bacteriological study of the milk played a role in the determination of its value as a food.

Milk continues to be an ideal food possessing all the food potencies currently designated as vitamines A, B and C. Physiological experts are asking repeatedly regarding the possible effects the handling of the milk at the dairy, creamery, bottling and pasteurizing plant may have on the nutritive qualities of milk.

Hess⁸⁴ summarizes the consensus of opinion of the present day with regard to that question by stating that there is increasing evidence that in the course of pasteurization milk loses an important measure of antiscorbutic vitamine. Although until recently it was believed that the variation in the food value of milk was dependent upon the breed rather than the food sources, recent reports show that the antiscorbutic properties of milk are dependent on the diet of the cattle. The experiments of Ducher,⁸⁵ *et al.*, showed that 20 cc of summer milk were superior in nutritive value to 60 cc of winter milk.

DIET IN CHILDREN.—Methods of basal metabolism determination have clearly demonstrated that the basal metabolic rate is higher for children, in proportion, than in adults. Holt and Fales⁸⁶ have recently reviewed the whole subject of the food requirements of children. They find that the food loss in the excreta is about the same for all ages after infancy, namely 10 per cent. The greatest requirement of food for growth is during the period that the growth is most active, namely,

⁸¹ Journal of Biological Chemistry, April, 1921.

⁸² American Journal of Diseases of Children, April, 1921, p. 315.

⁸³ Journal of the American Medical Association, April 16, 1921.

⁸⁴ Scurvy past and present, Philadelphia, 1920, p. 41.

⁸⁵ Journal of Biological Chemistry, December, 1920, **45**, 119.

⁸⁶ American Journal of Diseases of Children, January, 1921.

during the first year of life and during adolescence. The total daily caloric requirements of children of both sexes during adolescence exceeds by nearly 1000 calories the requirement of the adult man or woman of moderate activity. Children who are underweight require more calories per kilogram of weight than those who are of average weight for their ages. Children who are overweight for their ages, require fewer calories than children who are normal weight for age.

A real physiological need is represented by the fact that during adolescence the average boy or girl takes more food than the average adult man or woman.

DIET.—ITS RELATION TO DISEASES OF THE EYES.—Ophthalmologists have pointed out from time to time the relationship between nutritive disturbances and ophthalmia. Osborne and Mendel⁸⁷ noticed that eye disease did not occur among their albino rats when good nutritive conditions were secured by suitable diet. In 1913, they pointed out the value of butter fat over lard as a source of fat and that the introduction of butter fat in the diet alleviates disease of the eye promptly in their albino rats.

In their records of 100 unselected rats, it will be seen that no disease of the eyes developed in rats except those rats whose diet was deficient in fat-soluble vitamine. This ophthalmia did not yield to usual procedures of local antiseptic but, on the other hand, administration of vitamine-A in any of a considerable variety of food has almost invariably produced a disappearance of the eye disorder, even though the animal subsequently died.

DIET IN TUBERCULOSIS.—Considerable modifications of our conceptions of the food requirements of patients suffering from pulmonary tuberculosis has taken place during recent years. In order that we may have further help in better understanding this problem, it is hoped that basal metabolism studies may aid us in drawing additional conclusions.

Brown⁸⁸ believes that extra meat is necessary until the patient has a proper amount of protein in the body. If the excess of calcium salts is necessary, no food furnishes such an amount of the dietary essential as milk, combined too in a form very readily absorbed by the body. Brown believes that, although the examination of the blood of a patient suffering with pulmonary tuberculosis shows no variation in the calcium content, this is no argument against its use. He inquires whether it is not possible for the increased amount of calcium in the food to be passed on by the blood to tissues or scar formation.

The judicious use of milk will supply the body with sufficient fat-soluble vitamine in the diet of the patients. Cod-liver oil and butter fat contain this vitamine in large quantities, while all vegetable oils and fats are deficient in, or lack, it entirely.

FAT.—As an article of diet, fat has always been considered as an absolute essential, and this has assumed increasing importance because of the discovery of the fat-soluble vitamine and the role it plays in

⁸⁷ Journal of the American Medical Association, April 2, 1921.

⁸⁸ American Journal of Medical Sciences, September, 1920.

growth development. Before the World War an American consumed on an average $3\frac{1}{2}$ ounces of fat a day; an Englishman, $3\frac{1}{8}$; a German, $3\frac{1}{3}$; and a Frenchman, $3\frac{1}{2}$. The curtailing of the amount of fats during the war caused, it was believed, great hardship, and was blamed for some of the physical ills which visited the underfed people of the warring nations. Subsequent investigation shows that the shortage of fats cannot be held responsible, as, for instance, war edema, which was ascribed to this condition.

Fat is a potent food from the standpoint of its fuel content alone. One gram of carbohydrate and 1 gm. of protein yield each approximately 4 calories when combusted in the body. One gram of fat yields 9 calories. A study of the dietary habits of different races shows that the use of fats may be psychological as well as physiological. The taste of food is not pleasing without fat. The Japanese habitually eat little fat.

During the recent war the question was raised as to how much fat we do actually need. There being heretofore no exact data available on this subject, the Interallied Scientific Food Commission agreed to recommend, to the respective countries concerned, the adoption of 75 gm. ($2\frac{1}{8}$ ounces) of fat for the average man each day. As a desirable minimum of fat for human consumption this represents 700 calories, or approximately one quarter of the average daily energy requirement of each person involved.

Osborne and Mendel⁸⁹ have succeeded in securing growth from an early age to full adult size in animals on rations extremely poor in fat. The diet consisted of a mixture of protein, starch and inorganic salts, vitamines A and B. Hence, Osborne and Mendel cannot help but conclude that if fat is essential to growth, the minimum must be very small.

It would seem from the observations of Hinhede, on the results of his experiments with young men, that his conclusions with regard to the need of fat correspond to those of Osborne and Mendel on animals—if a sufficient amount of fresh vegetables and fruit is eaten daily to supply the vitamines.

PROTEIN IN HYPERTENSION AND NEPHRITIS.—Mosenthal⁹⁰ has made a study of the effect of diet containing high and low protein content respectively in hypertension, which resulted in some very interesting observations. It has been generally thought that protein in excess was injurious to patients with hypertension, but, from Mosenthal's observations, it would appear to be exceptional that a high protein diet decreases hypertension. Another disease in which it was thought to be a therapeutic blunder to permit the use of high protein diet was nephritis. This practice probably has as its basis the thought that excessive protein taken into the body would result in increasing the existing albumin in the same measure that increased carbohydrates in an untreated diabetic causes increased glycosuria.

⁸⁹ Editorial, *Journal of the American Medical Association*, March 5, 1921.

⁹⁰ *American Journal of the Medical Sciences*, December, 1920. **160**, 808.

Wordley⁹¹ has demonstrated that the variations in the amount of protein has no effect on the quantitative amount of albuminous matter excreted in the urine. In fact, there is no question that many patients have suffered unnecessarily because of the extreme restriction of protein in their diet that have been practised.

Scientific accurate clinical investigation has changed and will, no doubt, continue to change our ideas concerning diet in many conditions. Gradually the profession has learned that a typhoid patient can utilize carbohydrate in protein quite as well as a normal person, and that food in the proper state, soft or semisolid, can be given with better result than when the patient is kept on a liquid or low caloric diet. The inherited tradition of "feed a cold and starve a fever" is also in the process of change. No doubt this belief originated because it was believed that the digestive tract is greatly impaired in febrile disease, and that substantial food would be most detrimental to the body.

NUTRITIONAL STUDIES.—Rich,⁹² in commenting on the nutritional work done in the public schools of Chicago under the supervision of the Board of Education, believes that the results thus far attained more than warrant the endeavor put forth. While the development of the work was slow, intensive application of the methods on a small group was desirable, rather than a wider application with less close supervision.

The weighing and measuring was done at definite periods, and by the same nutritional worker for each group. Before the nutritional work was begun in any child, all carious teeth, diseased tonsils, adenoids and errors in vision were attended to. The development of the work indicates that the undernourished children lend themselves to three classifications: (1) Infants and young children up to the age of six years; (2) children from six to thirteen years; and (3) boys and girls from thirteen through the period of high-school education.

The handling of the first two groups is an expensive undertaking, requiring coöperation of the parents, and consequently many visits of a capable worker. The third group is controlled almost exclusively through the presentation of the problem to the individual student and through his own efforts to become mentally and physically fit.

VITAMINES.—It has long been known that there were substances in food which are necessary to the development of the human well-being, which are apart from the heat-producing portions of caloric value of the food. These unknown substances are termed vitamines. Chemists and physiologists do not know exactly what these substances are any more than the physicists can tell what electricity is, but they know what the vitamines can do, or rather what will happen to the person who is deprived of them.

Three forms of vitamines are recognized. The first, the scurvy-preventing or antiscorbutic vitamine, has been recognized for a long time. Scurvy has been a well-known disease, especially in the time of

⁹¹ Quarterly Journal of Medicine, October, 1920, **14**, 88.

⁹² Journal of the American Medical Association, November 27, 1920.

the old sailing vessels. When Massachusetts was a sea-going community, scurvy was common on shipboard where it was impossible to provide fresh foods and vegetables for long voyages. It became known that lime juice, and fresh vegetables when obtainable, prevented scurvy or cured it when it had developed. Later, when artificial feeding was developed, it was found that babies fed on carefully prepared, that is, sterilized milk often did not thrive and sometimes developed hemorrhages resembling old-fashioned scurvy. This condition of the baby, when recognized, was quickly overcome by giving the child orange juice or other fruit juice.

The vitamine preventing scurvy is known as the antiscorbutic vitamine. It is destroyed in food by heat and oxidation. It can be replaced and scurvy prevented by the administration of fresh orange, lime or lemon juice, also tomato juice, either freshly prepared or from a newly opened can (for the heat alone does not seem to destroy the valuable vitamine of the tomato). Incidentally, tomatoes have present two other forms of vitamines, and so are specially valuable as a food constituent. This accounts for the great popularity of both fresh and canned tomatoes today in the diet of the community. Somehow or other the public have instinctively recognized the need of tomatoes to their well-being, and adopted them as part of their diet. The laboratory has demonstrated scientifically the value of the tomato to every one as a palatable solution of all the vitamines necessary for human well-being, thus giving its approval to the tomato's popularity as a food constituent.

Fat-soluble vitamines have been found in animal foods, especially butter fats. Hence they are found in whole milk, cream, butter and cream cheese. Lard alone, of the animal fats, seems to be deficient in this form of vitamine. The vegetable oils do not appear to carry these very necessary vitamines. It is also found to be present in the yolks of eggs.

The fat-soluble vitamine is probably needed, especially during the growing period of life. It is needed for the complete development of a perfect body. Although the action of this form of vitamine is less understood than either of the others, there is more evidence of likelihood of serious pathological results arising in everyday life from the shortage of fat-soluble vitamine than of the other vitamines.

Like the other two vitamines, the fat-soluble vitamine as a chemical entity is unknown. Recently it has been demonstrated that this fat-soluble vitamine has been found in certain plants, such as spinach, tomatoes and especially in yellow pigmented vegetables, such as carrots, peas, sweet potatoes, yellow corn, etc.

The so-called water-soluble vitamines have to do largely, from a practical point of view, with the subtle thing called appetite. The loss of appetite is brought back by the presence of the necessary vitamines in the food, not simply by the increased injection of food or food flavors. That is to say, the vitamine must be present before the food can or will be taken and so utilized in the metabolism, or, in other words, used to build up the body tissues.

The water-soluble vitamine—the appetite-producing vitamine—has been refined out of our sugar, bolted flour and polished rice; also from our refined oils and fats. It is not found in ordinary meats or fish. No great harm need result from this careful purification of foods, which furnish the greater part of the calories used by the average American household, because other forms of food are generally added in sufficient quantities to supply the need for the necessary vitamines. Most people instinctively eat sufficient vitamine-containing foods, because milk, eggs, kidneys and liver are animal foods rich in vitamines, and, in addition most of the fruits and vegetables also contain the vitamines.

Fresh milk contains all three varieties of vitamines at present known. The vitamines of the fats are resistant to heat and are constantly present in eggs and milk, and the water-soluble vitamines are also able to withstand heat. On the other hand, the antiscorbutic vitamine is destroyed by raising milk slowly to a degree of heat necessary for pasteurization. Such milk rapidly loses its antiscorbutic vitamines.

It is known from many experiments that no animal can live upon a food which is a mixture of pure protein fats and carbohydrate, and even when the necessary inorganic salts are carefully added the animal cannot flourish. The animal body is adjusted to subsist either upon plant tissues or the tissues of other animals, and these contain countless substances other than pure protein starches, fats and salts.

Three of these active substances have been recognized under the term vitamines: Antiscorbutic vitamines, which prevent scurvy; fat-soluble vitamines, which favor body growth; water-soluble vitamines, which have to do with appetites.

The presence of all three vitamines is essential to bodily well-being, and even though the symptoms of complete vitamine starvation may not be present, nevertheless many vague symptoms of malnutrition often may be due to an insufficiency of vitamines in the diet.

The refined foods for the most part have lost their vitamines; thus our staple foods, such as flour, sugar, rice, macaroni, vegetable fats, lard and plain meats, are much deficient in vitamines.

Fortunately, a comparatively small amount of vitamine is all that is necessary to supply the requisite quantity for the body's development and well-being. All of the essential vitamines are to be found in fresh milk, eggs, coarse flours, most vegetables and fruits, especially tomatoes, oranges, grapefruit, lettuce, spinach, cabbage, cauliflower and other leafy vegetables; also peas and beans and grapes and other fruits. There is, therefore, no need of worry about a deficiency of vitamines when foods rich in vitamines are so easy to add to the ordinary dietary.

Karr⁹³ has shown that dogs fed on a liberal diet of isolated protein, fat, sugar, together with a commonly-used mixture of inorganic salts supposed to suffice for the body needs (a diet which several years ago would have been thought to be ideal) refused to eat after several days. As soon as the water-soluble vitamine was given, in addition to the same diet, the food was again taken. These vitamines were adminis-

⁹³ Journal of Biological Chemistry, November, 1920, **44**, 255.

tered separately in a manner as medicine would be given after a meal. If perchance the dogs continued to eat a diet without the addition of water-soluble vitamine, characteristic symptoms of polyneuritis may develop.⁹⁴

Vitamines in Nuts. Cajori⁹⁵ observed that satisfactory growth may be obtained in young rats fed on a diet, in which the almond, English walnut, filbert and pine nut, respectively furnished the essential source of protein in the ration. Normal growth can be secured when rats are fed on otherwise adequate diet containing the almond, English walnut, black walnut, Brazil nut, chestnut or pecan as the sole source of water-soluble vitamine. Animals that declined on diet devoid of water-soluble vitamines promptly recovered when the aforementioned nuts were added to the diet.

In a study of the effect of coffee on the production of a polyneuritis and paralysis produced by feeding pigeons polished rice, Mattei⁹⁶ noted that nervous symptoms promptly disappeared and the pigeons became normal for a time. Their condition remained satisfactory for several weeks, the coffee apparently making up for the deficiency in the polished rice. Suddenly, at the end of four to six weeks in some pigeons, the paralysis returned and the condition was as grave as before. Others remained in good health, but without gaining in weight. He obtained better results from the use of infusions of unroasted coffee than roasted coffee. He describes experiments in which he fed an excessive amount of bran, very rich in vitamines, with the result that they lost rapidly in weight and strength; to keep them alive a little rice had to be given however.

Digitalis.—Clinical and laboratory evidence show that the use of digitalis during the treatment of *acute infectious disease* is practically valueless. Hare⁹⁷ states that it is almost the universal experience of clinicians that, while digitalis often produces remarkable results in cases of valvular disease associated with ruptured compensation, it is, in the majority of instances, disappointing as a cardiac stimulant in the presence of an acute infectious fever. He quotes Hirschfelder and others as having reported, in hearts of animals in which the muscle was free from injury due to prolonged fever or toxemia, the factor of high temperature was sufficient to render it much more susceptible to digitalis' effects than is the heart muscle when not exposed to a high temperature. These observers quote Hart as having reported heart block in the administration of 3-dr. doses of tincture of digitalis in cases of influenzal pneumonia, and state that this quantity is almost half the dose in which similar effects might be expected in afebrile heart cases.

Luten⁹⁸ states that in administering digitalis, a consideration of the *proper dosage* is important. In recent years much larger doses have been given than were formerly employed. It has long been asserted that smaller doses have a tonic effect on the heart muscle; but, as was

⁹⁴ *Journal of Biological Chemistry*, November, 1920, **44**, 277.

⁹⁵ *Id.*, September, 1920, p. 583.

⁹⁶ *Policlinics*, Rome, September, 1920, **27**, 37.

⁹⁷ *Therapeutic Gazette*, September, 1920.

⁹⁸ *Journal of the American Medical Association*, January 1, 1921.

just said, there is no very conclusive evidence that digitalis in any dosage increases the tone of the human heart. In auricular fibrillation, however, in which the effect of the drug can be rather accurately measured, definite conclusions as to dosage have been arrived at. The method worked out by Eggleston⁹⁹ is now in general use when one is giving the drug under conditions that allow careful and frequent observation of the results. Under this method the preparation to be used is standardized in terms of cat units, and the dose of this standardized preparation is made proportional to the weight of the patient. The dose of an average tincture, determined in this way, will be about 15 cc per 100 pounds. That is to say, a man weighing 150 pounds would receive 22.5 cc, or about $5\frac{1}{2}$ dr., of such an average tincture. This may be given at one dose, or, better, over a period of twelve or eighteen hours. In this way the patient gets quickly the full effect of the drug.

In giving such "massive" doses to patients showing auricular fibrillation, and following the results by frequent counting of ventricular and pulse-rates, Robinson¹⁰⁰ found that the effects begin to manifest themselves within two or five hours after administration, and reach their maximum result sometimes within six hours, but oftenest within from fifteen to twenty-six hours. His results, as well as those of Eggleston and others, indicate that the tincture is usually well absorbed from the alimentary canal and is a satisfactory preparation for administration.

Such "massive" doses cannot, of course, be frequently repeated, nor is it necessary that this be done. The effects persist for a variable time, Robinson finding that the full effect in his cases persisted for from four to fifteen days. Partial effects last a longer time, and it is usually unsafe to give a full massive dose unless one is sure that the patient has not had digitalis for three weeks.

While it is unwise to give such large doses unless the effect can be frequently observed, still their employment with such striking results indicates that dosage has been too small and that better results will be obtained, in cases which the drug is indicated, under proper dosage.

Pardee,¹⁰¹ in a study of the *rate of absorption of digitalis* from the gastro-intestinal tract, finds that in patients who are not suffering from heart failure the variations in the rate of absorption are not great, and it may be surmised that this is also true of patients who are suffering from heart disease, because of the agreement of these figures with those which Robinson obtained, using, for the most part, patients with severely failing hearts. Digitalis given to patients manifests its action as early as three or four hours after the ingestion thereof, while the maximum effect is obtained at the seventh hour, whatever be the size of the dose. If the dose is small there may not be any effect noticeable, if it is sufficiently large, clinical improvement may follow shortly after the time of maximum effect.

The dose Pardee recommends as being safest under all conditions is

⁹⁹ Archives of Internal Medicine, July, 1915, **16**, 1.

¹⁰⁰ American Journal of the Medical Sciences, January, 1920, **159**, 121.

¹⁰¹ Journal of the American Medical Association, November 6, 1920, p. 1258.

a single dose of 1 minim of the tincture per pound of body weight, and should never be exceeded when a tincture of unknown potency is being employed. He believes the administration of a single dose equivalent to 1 minim per pound is inadvisable, except in the presence of urgent heart failure, when the patient is in bed and when prompt results are demanded. It should never be attempted if the patient has received any preparation of digitalis or its allies within a period of two weeks. He believes that digitalis need not be given at greater intervals than six-hour intervals, for the maximum effect of any dose will not be reached until six hours after its administration.

To maintain a continuous digitalis effect, the administration once a day appears to be quite satisfactory, and the average dosage thus required would be 20 min.

Warfield believes that from a safe therapeutic standpoint the Eggleston and Robinson methods of digitalis administration should be combined. To produce the best result, the dose of digitalis should produce slight nausea to which stage the patient should be brought at the earliest possible moment, then stop the digitalis. The maximal dose is calculated on the basis of 0.1 cc of tincture per pound of patient's weight given as a single dose of 10 to 20 cc. If this dose produces nausea, this is the proper amount to be given. If no symptoms are produced, give in six hours a second dose which is one-half the initial dose, a third dose in six hours which is one-half of second dose, and a fourth dose of the same amount as the third dose in six hours if no nausea be produced and no change in pulse. This would correspond to 0.15 cc per pound as Eggleston recommends. He cautions against giving this dosage if the patient has had any digitalis for ten days previously.

Digitalis therapy, according to Brugsch,¹⁰² is of no value in insufficient but non-hypertrophic heart; especially is this noticeable in acute cardiac insufficiency as the result of myocarditis in infectious diseases. He believes the study of clinical effects of digitalis by blood-pressure is of little value. Of much greater value is pulse frequency. If the pulse becomes normal, it is an indication of successful digitalis therapy. Hare,¹⁰³ in discussing the use of digitalis in diseases such as pneumonia, typhoid fever, diphtheria, in which it might be theoretically indicated, states that they are practically not only useless but may be actually harmful. He quotes the studies of McCulloch, who has studied the question of the use of digitalis in postdiphtheric cardiac disorders. He learned that the diphtheria poison is capable of producing a definite influence on the conduction apparatus of the heart, resulting in some form of heart-block. Digitalis is capable of producing the same effect in "massive" doses—even in a healthy heart. So that in the administration of digitalis solely as a circulatory stimulant, without considering all its effects on the heart muscle, it may, as in diphtheria, produce disastrous results, even in moderate dosage.

Eggleston¹⁰⁴ says of the many proprietary preparations and special-

¹⁰² Deutsche med. Wehnschr., Berlin, August 19, 1920.

¹⁰³ The Therapeutic Gazette, 1920, p. 251.

¹⁰⁴ American Journal of the Medical Sciences, November, 1920, p. 626.

ties which are offered with high claims for oral administration, none are superior to a good tincture or powdered leaf, and most are inferior. All these commercial products are quite costly and some are exorbitant in price. He states that he believes of the proprietary preparations digipuratum or digipoten will be found to be the best, but these are merely carefully assayed purified preparations from good digitalis leaves.

Hare¹⁰⁵ believes that digitalis in small doses with arsenic is of distinct value as a definite cardiac stimulant to the cardiovascular apparatus in the second and third decades of life in those patients who have the physical makeup described under the names D. A. H. and neurocirculatory asthenia during the recent war. Recurring courses of the drug should be given.

There have always been members of the medical profession who were strong advocates of the use of digitalis in the tincture form, or who believed that the use of the infusion was the only ideal method of giving digitalis. Weiss and Hatcher¹⁰⁶ have found some very interesting facts in connection with the infusion of digitalis. First, they found that they were able to prepare an infusion which had definite advantages over the one according to the present Pharmacopeial method. The authors prepare the infusion, according to the method devised by them, by pouring 1000 cc of boiling water into 10 gm. of digitalis in No. 60 powder in a flask or beaker, allowing the mixture to stand one hour in a boiling water-bath, with frequent stirring of the infusion in order to expel the air from the cells, thus facilitating extracting—water is added to replace that lost by evaporation; the infusion is filtered through paper after it is cool, or it may be filtered while hot when it is desired to maintain it in a sterile condition.

The advantages of this preparation over the official infusion is that better extraction of the drug is obtained whereby the infusion more fully represents the activities of the digitalis. The dose is just ten times that of the tincture volume. If the infusion is prepared according to the method herein described, filtered while hot and put in sterile containers, it is claimed by the authors that it may be kept indefinitely without loss of activity. One of the authors has had an infusion prepared, February 5, 1918, preserved under sterile conditions. Specimens of this infusion have been tested from time to time on cats and no perceptible loss of activity could be detected. The therapeutic effectiveness of an infusion prepared by this method was tested clinically by Cary Eggleston, and it was found that the dose required to induce the typical therapeutic effects was equivalent to that which he had established for the tincture as measured in terms of cat units.

Ether.—The vaccine treatment for *pertussis*, which has gained considerable popularity with variable results in recent years, has not given very satisfactory results for Genoese¹⁰⁷ in 40 patients whom he treated. The measure that has given him better and most reliable results is the injection deep into the gluteal muscles of 0.5 to 2 cc of ether. His

¹⁰⁵ The Therapeutic Gazette, 1920, p. 175.

¹⁰⁶ Journal of the American Medical Association, February 19, 1921.

¹⁰⁷ Pediatria, February, 1921, p. 187.

procedure was as follows: Three injections were made beginning at the sixth to the fifteenth day of the disease. The ages ranged from six months to eleven years. The treatment is kept up for from six to twelve days, making the injections every second day. The first injection may be painful, which can be relieved by massaging the spot with a mixture of alcohol and ether. There was never much swelling or suppuration. The vomiting stops, he states, as if by magic, the general condition improves and paroxysms are milder. The results were generally good in cases of pertussis complicated by measles.

Ethyl Chloride.—Guedel¹⁰⁸ states that this is an agent which is frequently employed for short anesthesia, but its action is little understood by many who employ it. It is the most rapid and powerful single anesthetic agent known except ethyl bromide which is not used alone. With an overdose of ethyl chloride, two entirely different sets of symptoms may be present. Four out of five cases receiving an overdose will manifest the spasm type of poisoning, while in the fifth case manifest respiratory depression type will be present.

Spasm Type. With the too rapid administration of this agent, over dosage, the patient will display at first clonic, followed immediately by tonic spasm of the muscles of the face and throat. There will appear a remarkable sardonic grin, accompanied first by tonic spasm of the masseters, locking the jaws with an unbelievable rigidity. About the same time there occurs a crowing respiration due to laryngo-pharyngeal spasm. With the continuance of the drug, respiration becomes more embarrassed by the progressively increasing spasm of the throat muscles, until it is cut off effectively as if the trachea were completely constricted, and a definite state of asphyxia is present. Under this circumstance it is extremely difficult to get the mouth open, and the patient may die before this is accomplished. Death here is due to active asphyxia.

This spasm may occur in any type of patient. There is no way to determine before the anesthetic is administered what to expect. If the anesthetic is administered by a novice, it is wise to insert a mouth-gag before starting.

Respiratory Depression Type. The incident of this is less frequent than the spasm type, and while more frightful in the beginning, it is easier handled if the anesthetist be alert.

With an insidious onset, the respiration during the late induction stage, or at any time during the conduct of anesthesia, becomes quietly and progressively shallower until it ceases altogether. This course from the onset consumes only about twenty to forty seconds. The picture is one of fatal shock, with extreme pallor, wide open, staring eyes with completely dilated pupils, and absolute muscular flaccidity, with no effort at respiration whatever. It is noticeable that at this point the pulse shows no change. With the mask removed, artificial respiration is to be started at once, making sure that there is the passage of air into and out of the lungs. The ethyl chloride is so rapidly eliminated from the circulation that but a few artificial respiratory move-

¹⁰⁸ Indianapolis Medical Journal, November, 1920.

ments are sufficient to allow the excess gases to be carried from the region of the medulla, and spontaneous respiration is again inaugurated.

Here again there is no way of anticipating this accident. There is no particular type in which it occurs. It, like the spasm, must be watched for and handled as it appears.

When not properly handled, death will ensue from passive asphyxia, with the heart stopping in from one to four minutes after cessation of respiration.

Guedel concludes by saying that ethyl chloride is a very useful anesthetic agent, but, like the racing automobile, it should not be handled by a novice.

Glucose.—Glucose has been employed by John¹⁰⁹ intravenously in the treatment of *pneumonia* in an army hospital with good results. He states that he has employed it more than one thousand times without seeing a single case where the effect seemed disadvantageous. He used routinely 250 cc of a 10 per cent solution of glucose, adding to it a small quantity of morphine, atropine and about 15 minims of the tincture of digitalis. Usually, following the injection, the patient experiences a sense of increased comfort, and often falls asleep.

An editorial in the *Therapeutic Gazette*, January, 1920, p. 19, discusses the *value of glucose when given by rectum*. This substance is frequently used today as an ingredient of nutritive enemata. The value of this rather common practice, from the standpoint of nutritive value of giving substances by bowel other than for its water content, has been disputed from time to time.

Not only have fluids been given by mouth, but thin cooked cereals, milk, beef juice, eggs, etc., all of which are usually predigested by pancreaticized powders with the hope of having the intestines absorb these substances for body nourishment. Physiological chemists have been unable to determine the presence of the latter substances in the body when administered by the rectal route, and enema given usually disclosed that these substances remained unabsorbed in the lower bowel. It was, however, discovered that glucose or dextrose administered by bowel seemed to have an appreciable value. In order to more fully satisfy himself by accurate means that this was a fact, Tallerman, of the Department of Chemical Pathology in St. Thomas's Hospital, London, undertook to study the blood-sugar percentage before the administration of glucose by bowel, as well as to determine the blood-sugar curve after its administration. McLean's method was used. He dissolved 2 ounces of solid glucose in 6 ounces of normal saline and injected this slowly into the rectum, following the method used commonly in rectal feeding, allowing ten minutes for the injection. The study of the percentage of blood sugar before and after rectal feeding of glucose showed that glucose was absorbed by the bowel, but that the glucose was absorbed three times as rapidly and almost double in amount when given by mouth as when given by rectal feeding. Naturally then rectal feeding of glucose is indicated only when there are contraindications for its use by mouth.

¹⁰⁹ American Journal of the Medical Sciences, October, 1920.

Iodine.—Vassalo¹¹⁰ has employed iodine in the treatment of *bubonic plague*. The iodine is administered intravenously. The composition of the solution used is: Iodine, 1 dram; potassium iodide, 1 ounce; and alcohol, 20 ounces. The solution is freshly prepared, and 10 to 15 minims in about 2 ounces of distilled water warmed to body temperature are injected into a vein. The dose is repeated when thought necessary, the temperature being the guide. The injection is repeated every other day until the temperature becomes normal and a last one is given when it has been normal for a day or two.

Wayson¹¹¹ has obtained good results from the use of *iodalbin in leprosy*. Iodalbin contains 22 per cent of iodine; it is given in 20-grain doses. In addition with the intensive use of iodine internally, he has attempted to use an iodinized autogenous serum.

Iodoform.—This drug is capable of producing numerous *skin lesions* especially when used in the local treatment of disease. Aperlo¹¹² dressed a tuberculous fistula in the lumbar region of a girl, aged three years, with iodoform gauze, which resulted in the symptoms of hemorrhagic purpura developing in the skin and bowel. The child had been under iodo-iodine treatment for three months and was probably saturated with iodine, thereby accounting for the iodoform producing these purpuric symptoms. Removal of the iodoform gauze resulted in complete recovery from the poisoning.

Grossman¹¹³ reported a patient who was operated upon for mastoid disease, in which iodoform packing was used. Subsequently the patient developed symptoms of meningitis in which rigidity of the neck and cranial nerve palsies were the only symptoms lacking. Laboratory tests were negative for spinal infection, and the symptoms promptly subsided when the iodoform gauze was displaced by plain gauze.

Ipecac.—Peshkin¹¹⁴ reports a patient suffering from bronchial asthma, which he believes is rare on account of its unusual rare type of protein hypersensitivity. The patient was a druggist and after careful history-taking, it was discovered that his symptoms were worse when he was compounding powders during the recent influenza epidemic. Cutaneous tests were applied of drugs commonly used during this epidemic and he was discovered to be unusually sensitive to ipecac, reacting to a 1:100,000 dilution. Ingestion of ipecac produced no respiratory symptoms, but inhalation resulted in immediate asthmatic symptoms. It must not be forgotten that asthmatic symptoms may arise in persons in contact with the dust of drugs, such as druggists or their families, or physicians and their families who have drug supplies in their homes.

These substances are quite capable of producing severe asthmatic attacks as is indicated by the ipecac sensitization.

¹¹⁰ Archives of Dermatology and Syphilology, March, 1921, p. 248.

¹¹¹ Journal of Tropical Medicine and Hygiene, London, April 1, 1921, p. 92.

¹¹² Polyclinics, October 11, 1920, p. 1148.

¹¹³ Medical Record, November 6, 1920.

¹¹⁴ Journal of the American Medical Association, October, 1920.

Luminal.—Sands¹¹⁵ has had most unusual results in the treatment of 86 cases of *epilepsy* by the sodium salt of luminal (*sodium luminal*), because of its greater solubility. As a rule, the dosage was three-fourths of a grain three times a day. Others required more than three doses and some did well on one dose a day, just before retiring. The results obtained were a definite diminution in number and severity of the convulsions. The convulsions were of shorter duration and the after-effects of the convulsions were less disagreeable. A less number of injuries were received during the seizures. No accumulation or after-effects were noted in any of the cases. With the discontinuance of the drug, the seizures return at more frequent intervals and with greater intensity.

Magnesium Sulphate.—In the various clinical antidotes for arsenic, magnesium salts in some forms are used as part of the antidote potion. Hansen attempted to establish the positive action of magnesium sulphate against the toxicity of arsenic. The average life of a series of 50 rabbits poisoned by arsenic was prolonged from two hundred and nineteen to four hundred and fifteen hours on the average, but it cannot be said to have saved life in rabbits.

Menthol and Peppermint.—McGuigan¹¹⁶ states that although menthol has a wide use in the treatment of colds by the medical profession and the laity, the latter also recognize its value in the extensive use of menthol cough lozenges. He ascribes its value to changes in the surface viscosity of the mucus, and in the membranes producing the exudates. These conclusions were drawn following experimentation on animals. Viscosity is also increased by cold air and decreased by warm, moist air.

Mercurochrome-220.—Schwartz and Davis¹¹⁷ conclude, from their experiment made with the view of determining the value of the drug in gonorrhea, that it has a powerful effect against the gonococcus. The gonococcus is about forty times as susceptible to the action of mercurochrome-220 as is *Bacillus coli*. Solutions of this drug lose their germicidal potency on standing and should, therefore, be used only when freshly made.

Mercury.—Adamson¹¹⁸ reports unqualified success by the application of liquid acid nitrate of mercury to the lesions of *lupus vulgaris*. The solution is applied by means of a small swab of wool tightly twisted around the ends of a finely pointed pair of forceps. It is painted on the affected areas freely and with firm pressure for one or two minutes, taking care to limit the application exactly to the lupus patches, to isolated nodules or to ulcerated surfaces. It is necessary to reapply the solution at the end of a week if the first application has failed to produce a healthy-looking scar. No complete cure can as yet be claimed in an extensive case of lupus, because the employment of the remedy has not been long enough to justify a more general use of the acid nitrate of mercury in the treatment of lupus.

¹¹⁵ Arch. Neurology and Psychiatry, March, 1921.

¹¹⁶ Journal of the American Medical Association, January 29, 1921.

¹¹⁷ Ibid., March 26, 1921.

¹¹⁸ British Medical Journal, July 24, 1920.

A rather unique method of studying what becomes of intramuscular injections of insoluble mercury has been carried on by Cole,¹¹⁹ *et al.* These workers studied this by means of roentgen-ray plates, which gave perfect pictures of the unabsorbed insoluble mercury preparation. Repeated roentgen-ray examination at intervals followed the absorption.

An extensive study of clinical cases gave the following as the time when absorption is completed.

Mercuric salicylate: By gluteal muscles: means, four days; extremes, four to ten days. By lumbar muscles: mean, eight and a half days; extremes, two to beyond twenty-four days.

Calomel: Mean, fifteen days; extremes, four to thirty-nine days.

Gray oil: Unabsorbed during entire period of observation, a mean of forty-three days; extremes of sixteen to one hundred and twenty-five days.

These findings indicate that gray-oil injections are both inefficient and dangerous, and their use should be abandoned.

Calomel injections are also dangerous.

Mercuric salicylate injections, especially into the gluteal muscles, give a satisfactory absorption and present relatively little danger.

The authors have recently seen a case of poisoning from gray-oil injections in which none of the drug had been received for four months. Roentgen-ray examination revealed large masses of metallic globules.

Ramsey and Groebner¹²⁰ state that from a series of experiments conducted with the view of determining the relative efficiency of the different mercurial preparations they have come to the following conclusions.

Mercurial ointment, 50 per cent, is to be preferred to the less concentrated forms and need not be repeated more often than twice weekly instead of daily. The quantity of mercury absorbed is much increased by friction.

Calomel ointment is absorbed, but less rapidly, and to a less extent than the mercurial ointment, and should therefore be given in greater concentration.

The salicylate of mercury in oil should be given hypodermically twice weekly instead of once.

The mercuric chloride, by hypodermic injections, although the dose is very small, continues to be eliminated for six or seven days. The fact, however, that its use frequently is followed by the appearance of protein in the urine should exclude it from the treatment of syphilis in children.

Calomel by the mouth is absorbed in small amounts, and continues to be eliminated for a considerable time, so it is probable that it would be sufficient to give it at intervals of several days, thus avoiding diarrhea.

Gray powder is absorbed to a small degree and eliminated rather rapidly, so that large doses repeated daily would probably be necessary to maintain mercury in the circulation.

In one case of congenital syphilis, with marked keratitis, treated by inunctions of 50 per cent mercurial ointment, once weekly, the clinical

¹¹⁹ Journal of the American Medical Association, December 4, 1920.

¹²⁰ Paris Médicale, December 11, 1920, p. 437.

progress was apparently quite as satisfactory as in cases in which daily inunctions were given.

Milan called attention, in 1907, to symptoms of the chest or the abdomen resembling pneumonia or peritonitis, which are manifestations of general *poisoning by mercury*. He¹²¹ describes mercury colic as an acute poisoning of the chromaffine system, often favored by massive absorption of the drug owing to horseback riding, a long walk or similar muscular exertion, on a basis of preexisting suprarenal deficiency. Treatment should include an abundant diet, regardless of the anorexia, as the mercury forms insoluble albuminates, etc., with the albuminoid elements of the food. The physical depression requires rest in bed, and the pain, sedatives. A full daily bath at body temperature for half an hour is one of the best means to relieve the pain while it promotes diuresis and elimination of the mercury by the kidneys and skin. Purgatives should not be given, as they merely increase the pains, but a belladonna and opium suppository may be useful. The main indication is to give adrenalin, 20 drops of the 1:1000 solution three times a day in a little water. In resuming the mercury, smaller doses by another route should be preferred, with intervals not less than seven days, giving calcium salts with it, and 40 drops of the adrenalin solution daily.

Methylene Blue.—Block¹²² used, with good effect, methylene blue in the treatment of trichomonas infestation. The drug was given by mouth and as a rectal irrigation. His patient received by mouth 3 grains of the drug three times daily, and by rectum irrigation 10 grains to a quart of hot water morning and night. Rest in bed and a liquid diet were ordered. The treatment was kept up for five days, discontinued for three days, and repeated for five days. By this time the diarrhea entirely subsided, the distressed feeling disappeared and the patient gained in weight.

Morphine.—It is a well-known fact that when the dose of morphine is frequently repeated, there is a decrease in the effect of this dose. Many explanations have been offered, but none has fully answered all the requirements of explaining the cause of this so-called immunity to the drug. Pellini and Greenfield,¹²³ in a series of experiments, concluded that no substance is formed in the blood serum of a human being who has acquired a high tolerance of morphine, which is capable of conferring any degree of immunity to the toxic action of morphine on an animal into which it is injected. No protective substance against morphine has been found in the blood of tolerant animals.

Lambert's¹²⁴ wide experience with drug addicts convinces him that all forms of narcotism cannot be routinely treated alike, and that the therapeutic care must therefore vary not only with the kind of narcotic taken, but, to a certain degree, with the amount and the length of time in which it has been indulged. The care of the patient is also greatly influenced by the cause which originally prompted the choice of narcotics.

¹²¹ Paris Médicale, December 11, 1920, p. 437.

¹²² Nebraska State Medical Journal, December, 1920.

¹²³ Archives of Internal Medicine, September, 1920, **26**, 279.

¹²⁴ Therapeutic Gazette, December, 1920.

Nearly every case of narcotism has a different cause. It is impossible to deal with the problem as a mass of humanity poisoned by the same intoxicant. To be successful in the treatment, the individual variation of a general problem must be solved. Often, during the process of unpoisoning, one realizes that what seems to be but the physically poisoned individual, easily separated from his narcotic proves to be a sick-souled, unhappy personality, congenitally inadequate to face his existence and who must be entirely trained and built up to face the world and its future.

Opium, laudanum, paregoric and morphine are the preparations usually used to relieve bodily pain, or taken for medicinal purposes in times of mental distress or insomnia, or in the later years of life to relieve the weariness. During youth, drugs supplying stimulation and inflation of personality are desired, and heroin, cocaine and alcohol are therefore chosen to furnish these qualities.

The treatment of the individual therefore deals with two distinct problems, unpoisoning from the narcotic, and the removal of the cause for the taking of the drugs.

The unpoisoning from the narcotic is brought about by three chief methods of procedure: (1) That in which hyoscine forms the dominant control; (2) that in which the action of belladonna is relied upon; and (3) the hypodermic injections of eserine and pilocarpine. There is also a method in which nothing but strychnine is given, to stimulate the person during the periods of nervousness, and practically nothing else done to counteract the withdrawal symptoms. Most patients who have taken opium, or its derivatives, for a long time required most active catharsis daily. They are more comfortable and do better if these measures are instituted. He states he has heretofore published in detail each one of these three methods of treatment. He considered the after-care of the patients of the utmost importance and unless the patient is given sufficient treatment and supervision, all the active measures for unpoisoning the patient will be futile and the patient will soon return to his old habits. The after-care is a personal problem, and this can only be carried out successfully by dealing with the patient in a straightforward manner. Unless the physician has the confidence of his patient, nothing can be accomplished. The physician must deal with his patients in a straightforward manner and promise nothing which he will be unable to deliver. In treating a narcotic patient, it must be remembered we are not dealing with a definite clinical entity with its pathology, but we are dealing with a functional poisoning resulting in perversion of the functions of the body.

Novarsenobenzol.—D. Esterre¹²⁵ has had excellent results in the treatment of recurrent malaria by novarsenobenzol. He has seen during the past three years at least 500 cases of recurrent malaria from all parts of the world, and has been struck by the fact that the usual varieties of quinine treatment did not free the patient from the disease, as shown by blood smears and differential. His method of adminis-

¹²⁵ Lancet, September 11, 1920.

tering the novarsenobenzol consists of two injections given intramuscularly of 0.3 gm. in 5 cc of 0.5 per cent sterile saline followed by two injections given intramuscularly of 0.4 gm. in 7 cc of 0.5 per cent sterile saline. These injections are given at intervals of one week. The injections are made in the gluteal muscles. He states that only 3 out of 38 patients given this treatment have reported that they think they have had a "slight attack" since leaving the hospital.

Oxygen.—Jacoulet¹²⁶ reports that the life of a patient dangerously ill has been saved by the subcutaneous administration of oxygen. The patient, a plumber, had been exposed to nitrous fumes for several minutes while doing some work in a chemical fertilizer factory, following which he felt great malaise and by night was suffering from a distressing spasmodic cough which became progressively worse, so that at the end of thirty-six hours he was in a desperate condition. The subcutaneous administration of oxygen was begun through a serum needle. In four hours, more than 80 liters of oxygen were thus injected, forming an emphysema over the entire body to the base of the neck, and the man recovered rapidly.

Phosphorus.—Phemister,¹²⁷ *et al.*, found that the end-results produced by treating rickets with phosphorus and cod-liver oil were quite similar to those treated only by phosphorus. Clearly, phosphorus and also cod-liver oil in some way restore the power of normal ossification of bone which in rickets is temporarily lost.

Pituitary Extract.—Gibson and Martin¹²⁸ studied thoroughly the effects of pituitary extract and *histamin* on a case of severe *diabetes insipidus*. The subcutaneous administration of pituitary extract (doses, 1 cc each of the obstetrical preparation) was effective temporarily in increasing the concentration and reducing the volume of urine as reported by other observers.

Desiccated whole pituitary substance in four 3-grain doses by mouth had a slight immediate effect.

Histamin (one injection of 0.2 gm.) gave a similar, but less effective, result. It is probably not the active principle of the pituitary gland.

Schulmann and Desoutter¹²⁹ state that extract of the posterior lobe of the pituitary is unquestionably the most effectual treatment at hand for diabetes insipidus, although it does not definitely modify the prognosis. It controls the two distressing symptoms, namely, unusual thirst, and the indefinable malaise which prevents sleep. The administration of pituitary extract in this disease over a long period of time is practically without harm.

Brunn¹³⁰ states he believes that the antidiuretic effects of hypophysis extracts are due to the blocking in the kidney, and opposes the theory that it acts by tissues holding back the fluid so that they cannot give it off to the blood stream.

¹²⁶ Paris Médicale, November 20, 1920, p. 369.

¹²⁷ Journal of the American Medical Association, March 26, 1921.

¹²⁸ Archives of Internal Medicine, March, 1921.

¹²⁹ Revue de Médecine, Paris, October, 1920, p. 520.

¹³⁰ Zentralblatt für innere Medizin, September 25, 1920.

Two cases of diabetes insipidus were treated by Winslow with pituitary extracts, in which immediate and favorable results were obtained. One of the patients had encephalitis four months previously, and he ascribes the polyuria to involvement of the pituitary gland by the encephalitic process. In the second case the onset was slow and, except for pyorrhea, abscessed teeth and chronic tonsillitis, no abnormalities were present. The first patient received pituitary extract 1 c c daily, and the second was given 0.5 c c twice daily.

Couland¹³¹ states that, because the suprarenals were found considerably hypertrophied in animals, he regards this as suggesting the necessity for pituitary treatment in all cases of asthenia of suprarenal origin and in Addison's disease, the contraindication to pituitary treatment being arteriosclerosis and nephritis.

Ruckner and Haskell¹³² believe, as the result of clinical and experimental observation, that the use of pituitary in *obstetric practice* is accompanied by danger to the mother and to the child. The danger to the mother is that there is an increased tendency to perineal laceration and an occasional occurrence of uterine rupture. The dangers to the child consist in the greater tendency toward the production of asphyxia and toward the occurrence of intracranial hemorrhage. They do not wish to convey the impression that the use of pituitary extract always results in a catastrophe, because the vast number of cases in which there is no apparent injury renders this attitude absurd. They do believe that there is a distinct danger in its use that is not warranted by the indications for which it is administered.

Placental Extract.—Bandler¹³³ states he has had excellent result from the use of placental extracts in the treatment of *headaches* so peculiarly typical in women, occurring in the occipital region radiating behind the ear and down the cervical spine. Usually, with these headaches, occur psychic disturbances characterized by restlessness and inability to be physically or mentally quiet. He ascribes these headaches to altered activity of the posterior pituitary and the results are due to the effects that placental extract exerts upon postpituitary changes.

Potassium Chlorate.—This drug is frequently an ingredient of tooth pastes, mouth washes and gargles, and it must not be forgotten that when swallowed in considerable quantity, it is capable of acting as a violent poison, especially producing blood destruction and nephritis. In Zuccola's¹³⁴ patient, 6 gm. of potassium chlorate had been taken with suicidal intent and a destructive action on the blood followed with profuse hemorrhages from the intestinal tract. Improvement followed the transfusion of blood, but, after four transfusions within a week, death finally resulted due to insufficiency of the kidneys.

Potassium Chloride—The experiences of Blum,¹³⁵ *et al.*, shows that potassium chloride is possessed of definite diuretic properties, increasing

¹³¹ Bulletin Medicale, Paris, September 25, 1920, p. 859.

¹³² Journal of the American Medical Association, May 21, 1921, p. 1390.

¹³³ New York Medical Journal, November 13, 1920.

¹³⁴ Polioclinico, January 17, 1921, p. 82.

¹³⁵ Bulletin de Société des Hôpitaux, Paris, May, 1921.

the output of urine instead of inducing retention of fluids like sodium chloride. In some instances it acted as a diuretic when all the other diuretics failed. In persons predisposed to attacks of diarrhea the drug produced a laxative effect. There is no cardiovascular by-effect if the cardiac system is intact, but otherwise there may be a fall in blood-pressure, cyanosis, dyspnea, a sensation of constriction and morbid apprehension, with extra systoles. To avoid these bad effects, the twenty-four-hour intake of the drug must not exceed from 5 to 7.5 gm. The drug should preferably be tested out by beginning with a small dose (1 gm.) and increasing the dose as conditions warrant.

Potassium Iodide.—Nammack,¹³⁶ in discussing the treatment of *arteriosclerosis*, states that potassium iodide is the one drug that is frequently prescribed. He states that its action has been the result of much controversy. Some writers believe that it acts as a vasodilator and thus decreases blood-pressure; others that it lessens the viscosity of the blood. Capps denies that it does either, and says that its only benefit is selective absorption of the cellular exudate in syphilitic arteritis. Lemoine believes that iodide of potassium is a therapeutic heresy. Hood states that it is now generally conceded that iodides and iodine have no place in the treatment of hypertension or arterial fibrosis. Nammack's own hypothesis is that salt-poor and salt-free diet should be pushed to the point of removal of the surplus sodium chloride from the body, and to keeping the tissue sodium chloride content at the physiological amount. To help accomplish this he advocates administering 1-per-cent solution of potassium nitrate, of which 15 drops are to be taken three times a day in half a glass of water until the individual is filtered of his excess chlorides.

Potassium Permanganate.—Balfour¹³⁷ states that Bender, of Breslau, regards the external application of a solution of permanganate of potash (as introduced by Dreyer in 1910) as superior to every other therapeutic measure in smallpox.

On admission to the hospital, the whole body is painted with a freshly prepared 5-per-cent solution of this drug. Unless the skin is too sensitive, this solution is applied daily. If the skin becomes irritated, as the result of a 5-per-cent solution, weaker solutions are used so as to have no irritating effect. The advantages of this treatment are that, especially if used early, it lessens the suppurative process, and prevents complications. As suppuration is lessened, the pitting of the skin is reduced. Finally, permanganate of potash possesses hygienic advantages by lessening the risks of infection.

Protein.—Protein therapy in the last six years has been heralded as more or less successful in the treatment of acute infections, arthritis, urological and dermatological conditions. This form of therapy also known as "non-specific therapy" is a new method of therapy so far as it represents the clear-cut recognition that certain clinical results heretofore obtained in a variety of ways and by a number of different substances were in reality due to a similar biological alteration on the

¹³⁶ Medical Record, November 6, 1920.

¹³⁷ Tropical Medicine and Hygiene, London, February 15, 1921, p. 37.

part of the organisms. Some of the results previously accepted on the basis of specificity we now know to have been due to this non-specific effect. In differentiating between the specific and the non-specific phases of resistance and in developing them in an unbiased manner, very definite therapeutic advances seem possible." (Peterson, *Journal of the American Medical Association*, January 29, 1921.)

This will explain the favorable results obtained from remedies used for a number of years in an empiric way. Serum, vaccines, proteoses, milk injections, tuberculin, Coley's fluid, trypsin, hypotonic and hypertonic solutions, metallic salts, formaldehyde, turpentine are among some of the substances which have been used intramuscularly and intravenously. Immediately following the intravenous injections of some of the above-named substances, a diphasic shock resulted. The first phase is associated with an exaggeration of the symptoms of the existing disease (negative phase) and next phase an improvement as compared with the conditions before the institution of the treatment (positive phase).

Culver¹³⁸ has used with very good results the intravenous injection of gonococcus and meningococcus vaccine in gonorrhreal infections of joints and epididymitis, no difference being noted if the gonococcus vaccine or meningococcus vaccine was used. The primary focus must be treated along with the use of protein therapy.

Engmann and McGarry¹³⁹ obtained satisfactory results in the treatment of 1 case of psoriasis by the intravenous injection of typhoid vaccine, marked improvement in 6 cases of lupus erythematosus, in 1 of dermatitis exfoliativa and in 1 case of parapsoriasis; and slight improvement in 1 case of dermatitis herpetiformis. Sufficient encouragement from treatment by others warrants the use of foreign protein therapy as a possible means of doing good in chronic skin disease.

Quinidine.—This is one of the alkaloids of cinchona bark. Until the recent discovery of the value of quinidine in the treatment of auricular fibrillation, the only drugs of value were digitalis and the digitalis action group. Jenny's¹⁴⁰ experience confirms the way in which quinidine is able to arrest auricular fibrillation and restore the normal sinus rhythm. This occurred in 11 of Frey's 22 cases, in 6 of Bergmann's 9, and in 1 of Klowitz's 15. In 17 of Jenny's 18 cases of auricular fibrillation and tachysystolia, the normal rhythm was restored by the action of quinidine. This took from 0.5 gm. to 15.5 gm. in different cases, and this effect was realized in from three hours to ten days. The pulse has kept regular since, to date in most cases, but the longest interval is only five months. It may be necessary to give the drug continuously, or to repeat the courses. Jenny's results surpass all previously published. He gave 0.5 gm. of quinidine two or three times a day. The tranquilizing action of the drug has been found useful in paroxysmal tachycardia and similar overexcitability. He says that

¹³⁸ *Journal American Medical Association*, January, 29, 1921.

¹³⁹ *Ibid.*, December 9, 1916.

¹⁴⁰ *Schweizerische medizinische Wochenschrift*, March 24, 1921, p. 272.

up to 1 or 3 gm. a day need not be feared, under constant supervision, but, at the slightest sign of derangement of vision or hearing, the drug should be dropped.

Boden and Neukirch,¹⁴¹ in reporting their experience with the use of quinidine in the treatment of extrasystolia and paroxysmal tachycardia, state that it has been a successful remedy. With absolute arrhythmia, the action was uncertain; in 17 cases, only 7 were restored to normal rhythm and this only transiently.

Quinine.—With the increased frequency in which intravenous injections of substances are employed, it is well to know beforehand the effect, if any, the particular substance to be used may have on blood-pressure. Brahmachari,¹⁴² in a study of the effects of concentrated and weak solutions of quinine given *intravenously*, states that weak solutions are the only safe ones to use, and that stronger solutions may be followed by alarming results. Intravenous solutions of quinine in concentrated form (10 gr. in 20 cc) is generally followed by a fall in blood-pressure and may be followed by a disappearance of the pulse for a few seconds. A solution equal to one-tenth of the strength of the previous solution may be followed by a fall in the blood-pressure, but this fall is neither so sudden nor so great as in the case of concentrated solutions. In many cases there is no fall in blood-pressure. The slower the injection is given, the less is the chance of the fall in blood-pressure taking place. Brahmachari states that quinine, if given intravenously, should always be given in very dilute form (1 to 300). The rate of administration should be 10 cc every minute, and frequent observation of the blood-pressure should be made during the administration and guarded by the use of pituitrin or adrenalin, and the application of tight bandages over the extremities.

Much has been written and numerous discussions have been held as to the advantages and disadvantages of the VARIOUS METHODS OF ADMINISTERING QUININE. Dixon¹⁴³ states that quinine, when taken by mouth, appears to be absorbed in a manner similar to that of other alkaloids. It passes for the most part through the stomach unchanged, and is absorbed from the duodenum. Dixon believes with MacGilchrist that "Subcutaneous and intramuscular injections (1 in 1 to 1 in 10) are inferior to quinine given by mouth in rapidity of action and thoroughness of absorption."

The two chlorides of quinine seem to Dixon to be superior in every way as compared with the other salts of quinine, especially to the sulphate, now so commonly used. If a strong solution of quinine is injected intramuscularly, it is fixed in the tissues and no absorption takes place.

Among the drugs to which some individuals manifest idiosyncrasy, when given in medicinal dosage, is quinine. Boerner,¹⁴⁴ by applying quinine bisulphate to a skin scarification made on himself and colleague

¹⁴¹ Deutsches Archiv f. Klinische Medizin, June 7, 1921.

¹⁴² Lancet, December 25, 1920.

¹⁴³ British Medical Journal, July 24, 1920.

¹⁴⁴ Journal of the American Medical Association, March 24, 1917, 68, 907.

—both of them susceptible to quinine—was able to obtain a definite and well-marked local reaction in each case. Similar tests in individuals who were nonsusceptible gave no reaction whatever. Boerner concluded that this reaction was specific.

O'Malley and Richey¹⁴⁵ tried out this skin test in 2 cases of quinine idiosyncrasy and confirmed the observations of Boerner. These confirmatory experimental tests lead the observers to believe that this reaction is observed only in individuals who are hypersensitive to this drug, and can be obtained by using only quinine salts as the antigen. It seems to be a specific reaction analogous to the other cutaneous reactions already known. The value of this test seems unquestionable in determining actual idiosyncrasy to quinine.

Sollman¹⁴⁶ states that some writers have attributed the *toxic effect of quinine* to the formation of a more toxic substance "quinotoxin" or quinicin, as it is more properly called. This, he states, may be formed under certain conditions in a prescription, as, for instance, in the presence of free organic acid. It has been assumed that these conditions would arise in the stomach, and, also, that prescriptions containing free organic acid and quinine would be dangerously incompatible. By an examination of facts, he concluded that the evidence did not justify this assumption, as, at most, insignificant traces of quinotoxin could be formed in the body or be present in such prescriptions. This formation of quinicin would take place very slowly and the quinicin would undergo further transformations into inactive products. Such solutions are perfectly proper if used within a few days. They should not be used after prolonged standing, when they become discolored and precipitated; not because they have become toxic, but because they have become inactive.

Radium.—Excellent results continue to be obtained by the medical profession in many diseased conditions where radium is used. More radium seems to have become available throughout the country and its use is no longer restricted to the larger hospitals, but either a physician, or a group of physicians, purchases the radium, and in this manner its application is becoming more general. Where large quantities of radium are available, apparatus can be used to put the radium emanations in tubes, which are as satisfactory in treatment as the application of radium itself. While radium is a very valuable agent, its use must be as thoroughly understood as other substances of great potency, since its misapplication may result in equally great harm. Then again, seizing upon the popularity that radium has gained through its scientific use, numerous imposters have made fraudulent claims for substances they sold, stating they contain radium or are possessed with its activity. Not only has the laity, but also the medical profession been defrauded by such false representation. Ninety-nine times out of a hundred these substances are valueless so far as their radium activity is concerned.

Radium element is sold at prices ranging from 100 to 120 per mg., and radium should not be purchased from any one until it has been

¹⁴⁵ Journal of the American Medical Association, December 27, 1919.

¹⁴⁶ Ibid., April 9, 1921.

examined and standardized by the Bureau of Standards of the United States at Washington, D. C.

Radium has been used very frequently in the treatment of *leukemia* with most variable results. Renon and Degrais¹⁴⁷ report the outcome of 8 cases treated by radium over a period of ten years. The radium was applied over the spleen, and the application to the bone marrow may also be warranted, if there is reason to assume fibrous transformation of the spleen. Their immediate results were remarkable, and the patient appeared cured, but in from two to eighteen months the signs of leukemia returned, and the radium appeared to lose its effect. The myelocytes seem to become highly resistant to the radium rays. The lesson to be learned from this is to give large intensive doses with longer intervals. With regard to its effect as compared to roentgen rays, their action is closely analogous. They believe that the life of a patient with leukemia may be lengthened by five or six years by radium therapy.

Clagett¹⁴⁸ states that the treatment of *goiter* by radium has the advantage over *x-ray* in that it produces no dark discoloration of the neck that has followed *x-ray* treatment. Radium can be used on a nervous patient where *x-ray* would be prone to cause excitement, and, furthermore, radium can be carried to the patient's home. He gives the summary of 47 cases of exophthalmic goiter treated with radium. The first case was treated in 1917. The age of the patients varied from sixteen to seventy-four years. Of the 47 cases, 6 had already been operated upon, with recurrence of symptoms as bad as or worse than before. Seventeen cases were declined as operative risks by some of the best surgeons. Eight patients had to have the radium applied twice, as one dose was insufficient to give satisfactory results. During the treatment of these patients, surgery has not been necessary in any case. Two of the patients of this group died with failure of the heart, whose myocardial degeneration was well advanced at the time the treatment was given.

Aikens¹⁴⁹ reports that an experience of twelve years has convinced him of the value of radium treatment in toxic goiter, of which he has seen about 100 cases so treated.

Newcomet,¹⁵⁰ in making a report on the result obtained in the radium department of the Jefferson Medical College Hospital, Philadelphia, which extends over a period of six years, deems it proper to call attention to some of the earlier work and to correct a prevailing idea that the benefit received from the agent is only temporary. He believes that there is not the least doubt that in the next decade, by still refining its application, more favorable results may be expected. The important point appears to be not so much the form of application as the manner of application.

He speaks most enthusiastically of the benefit of radium therapy

¹⁴⁷ Bulletin de l'Académie de Médecine, February 15, 1921, p. 207.

¹⁴⁸ Illinois Medical Journal, October, 1920.

¹⁴⁹ American Journal of Roentgenology, August, 1920, p. 404.

¹⁵⁰ Therapeutic Gazette, 1921, p. 313.

from the standpoint of comfort given to inoperable and otherwise doomed cases. Much good, and, in some cases, apparent recovery from carcinoma of the larynx has resulted. In carcinoma of the esophagus, the result, while encouraging, demands further improvement in the technic. The results in the treatment of keloid have, as a rule, been exceptionally good.

The results in treatment of *carcinoma* of the uterus shows a marked improvement compared with that of previous years, owing to the class of cases treated and the improved technic. When the department was first opened, only such cases as were absolutely hopeless, and there was nothing to offer by other forms of treatment, were referred for radium. Yet even from this class such results were obtained that today radium is applied in the early stages as well as the inoperable, with a decided improvement in the record of non-recurrence.

The results on other pelvic structures have not been so good as those obtained in the uterus, although several cases of malignancy of the bladder and urethra showed marked improvement.

Several cases of malignancy of the rectum have been under observation, one for three years and another for five years, although the disease was far advanced and there is still evidence of disease, but the patient is comfortable and free from bleeding.

The mouth has always been a most difficult part of the body to treat successfully, especially when the disease attacks the tongue or the mucous membrane overlying the alveolar portion of the jaw. The usual case coming to the department for treatment was so well advanced that improvement was only temporary.

After a lapse of eight years, Rouillard¹⁵¹ reports that his patient afflicted with inoperable carcinoma of the pharynx involving cervical gland is well as the result of radium treatment over one year's duration. Another patient, aged sixty years, who had a tumor of the breast removed, which microscopically was diagnosed scirrhous cancer, was treated by radium for one year. Eight years have elapsed since operation, and the patient is in perfect health, although she recently suffered from cough and increase in the volume of the liver.

Epitheliomas upon the face, when seen early, react favorably to any form of radiation. Cases of sarcoma are unusually refractory to all forms of treatment. Newcomet states that where a small nodule, believed to be inflammatory or tuberculous, has disappeared very rapidly, it has been his experience that it returned within a year or two at some distant part of the body and was sarcomatous in nature. Tuberculous nodules reduce slowly and leave a hard scar.

Benign Cases. The most interesting group in this class are those of the fibroid uterus with hemorrhage due to various causes, some of which are difficult to determine, especially where there is some contraindication to surgical intervention. Here radium has been able to control the hemorrhage and allow the individuals to recover.

In Vineberg's¹⁵² opinion, the treatment of *fibroids* in young women

¹⁵¹ *La Presse Médicale*, November 13, 1920.

¹⁵² *Medical Record*, January 15, 1921, p. 91.

is indicated in those who refuse operation. There are certain women who rather than submit to surgical procedure will go on suffering pain and loss of blood. If the patient is under forty years, the physician tries to impress her with the advantages of surgical procedure and the preservation of her menstrual function and the removal of the tumor, or tumors, by surgical operation.

Levin¹⁵³ believes that not all failures from the use of radium must be ascribed to the inefficiency of the agent. The number suitable for radium is no greater than the number in which radical surgery is indicated.

In a report of the results obtained from radium treatment in 600 cases of *menorrhagia*, Stacy¹⁵⁴ states that, in young women with fibroids causing menorrhagia, radium should be used only in selected cases, and in small amounts in the initial treatment. Pregnancy may occur after the application of radium, but in a small percentage of cases only.

The experience of Quigley¹⁵⁵ suggests that excellent results are to be obtained from radium in the treatment of acute and chronic cases of *x-ray* burn and that, if used in the acute state, a smaller dose of radium will suffice and less tissue be destroyed. The *x-rays* are irritating and poisonous, and the rays of the radium are benign and healing.

Saligenin.—This drug is chemically salicyl alcohol and it has been introduced as a relatively non-toxic anesthetic. It is about one-fifth as toxic to mammals as procaine and about one-fiftieth as toxic as cocaine. Hirschfelder and Wynne¹⁵⁶ tested it out clinically in cystoscopy in a series of 26 cases. In all cases 2 cc of a 4 per cent solution of saligenin was injected into the urethra and a pledget of cotton soaked in some solution placed over the external urethral meatus for five minutes. A working anesthesia was obtained in each case as satisfactory as that produced by a 10 per cent solution of cocaine. In a few cases we tried a 2 per cent solution, but it was unsatisfactory. It would appear, therefore, that saligenin is a practical non-toxic local anesthetic which is distinctly useful in work on the female urethra and bladder.

Serum.—ANAPHYLAXIS.—Most of the recorded cases of sudden death with symptoms of anaphylaxis, which have resulted from injections of foreign protein in man, according to Lewis, have followed subcutaneous injections. An exhaustive study by the same observer leads him to believe that the absorption of serum from the subcutaneous tissues is very slow. The main route of absorption from the subcutaneous tissues is through the lymphatics. The rate of absorption of horse serum injected subcutaneously is apparently too slow to explain the cases of sudden anaphylactic death which have occasionally followed the administration of antitoxic serums in man.

Certain procedures, such as massage of the site of injection and injecting large volumes under high pressure, can hasten the appearance in the circulation of horse serum injected subcutaneously. Because of

¹⁵³ American Journal of Roentgenology, November, 1920, p. 522.

¹⁵⁴ Ibid., August, 1920, p. 379.

¹⁵⁵ Urological and Cutaneous Review, October, 1920.

¹⁵⁶ Journal of the American Medical Association, December 25, 1920.

the suddenness with which it appears, and because of the analogy to the occurrence of fat embolism after the subcutaneous injection of oily substances, acute anaphylactic death in man following subcutaneous injections of horse serum is probably due to accidental intravenous injection of the serum. The need of care to exclude, as far as possible, the injury of a subcutaneous bloodvessel during the subcutaneous injection of horse serum is indicated.

ANTHRAX.—According to a monograph published by the National Institute of Hygiene of the Argentine Republic, Penna Cuenca and Kraus described remarkable results in the treatment of anthrax by the use of normal *ox serum*. In their experiments they learned that the serum from an immunized animal, even an immunized ox contained no more protective power than normal ox serum. Before use, the normal ox serum was heated twice for half an hour to 56° C. for the purpose of eliminating any toxicity it might possess. Ox serum so heated did not produce in man any bad reaction, even when injected intravenously. The usual method was to give from 30 to 50 cc, which, in bad cases, is injected intravenously, but in milder cases it may be given subcutaneously or intramuscularly. In mild cases it may not be necessary to use so large a dose. The dose is repeated in twenty-four to forty-eight hours, if necessary.

DIPHTHERIA.—*The Schick Test.*—Along with other means of reducing the morbidity and mortality of contagious diseases, we have seen more generally used a test which can be readily performed and interpreted for the prevention of diphtheria.

Numerous drug supply firms are now putting it on the market in small packages ready to use with specific directions, and in the use of control injection, which therefore places the test within every physician's reach who desires to use it.

The test is of distinct value under the following conditions: In children's homes, hospitals, schools, etc., where epidemics of diphtheria break out. If every inmate is known to be either positive or negative to the Schick Test, a less number of immunizing doses of diphtheria need be given, fewer quarantines and less laboratory work will be necessary.

To those healthy individuals who show a positive test, immunization to diphtheria can be produced by the injection of toxin-antitoxin mixture, the result which follows along the lines as the protection afforded by typhoid vaccine for the prevention of typhoid fever.

Blau¹⁵⁷ gives his experience and valuable information, which must be used in the interpretation of the Schick test. He states that the method of injection is the same in all tests—in the capillary control test, and in the stock solution Schick test. The procedure should be uniform in all tests, and conducted as follows: Sterilize the skin with cotton soaked with alcohol and then insert the needle into the skin.

An efficient guide for the introduction of the needle into the proper layer of the skin is to be able to see the oval opening of the needle through the superficial layers of skin cells.

A definite, blanched, circumscribed, wheal-like elevation, the size of a dime, with the markings of the openings of the hair follicles distinct, shows that the injection is properly made. An ordinary 1 cc hypodermic syringe, with a fine $\frac{1}{2}$ -inch needle, can be used for the injections. The site of the injection need not be covered.

The reactions should be observed at the end of twenty-four and forty-eight hours, basing the final judgment on the reading. In case of doubt, a reading should also be made at the end of four days.

1. The positive (+) reaction becomes apparent at the end of from one to four days, generally at the end of two days, at a time when the pseudo element of the reaction has disappeared. It consists of a definitely circumscribed area of redness, from 1 to 1.5 cm. in diameter, with a superficial scaling and a beginning brownish pigmentation. A strongly positive reaction will occasionally show vesiculation of the surface layers of the epithelium. The reaction gradually disappears in from one to four weeks, going through various stages of scaling and pigmentation. After about two weeks a distinct brownish area is seen at the site of the injection.

2. The negative (—) reaction. In most cases nothing is seen at the site of injection. In a small proportion of cases a pseudoreaction is manifest.

3. The pseudoreaction shows an indefinite area of redness of varying size, surrounded by a secondary areola, which shades into the surrounding skin. The pseudoreaction appears earlier than the positive reaction, in from six to eighteen hours, reaches its height in from twenty-four to thirty-six hours, and has disappeared by the end of from two to four days, at a time when the positive reaction becomes apparent, and may leave a poorly defined area of pigmentation, but generally no scaling.

4. The combined reaction showing a positive and pseudoreaction in one. The positive element of the reaction becomes apparent at the end of from two to four days, at a time when the pseudo-element of the reaction has disappeared. The appearance of the positive element of the reaction is that described under 1. The appearance of the pseudo-element of the reaction is that described under 3, and resembles the reaction at the site of the control test, if there is a reaction at the control, with which it should be compared.

5. The doubtful (+—) reaction. At times doubt arises as to what the reaction really is. The reaction may not be typically a pseudoreaction. In such cases, the leaning should be toward a positive reading.

6. In the control reaction, as a rule, nothing is manifest at the site of the control test. Occasionally the control test shows a pseudoreaction.

(a) A positive reaction. If the person tested is not immune to diphtheria, the toxin in the Schick test will exert its irritant action, and the reaction is positive. A positive reaction shows that the individual has no antitoxin in his blood, showing that he is not immune to diphtheria, and that he needs active immunization against the disease.

(b) A negative reaction shows that the individual is immune against diphtheria, and therefore needs no active immunization. It also indicates, in children over eighteen months of age, the development of a natural immunity against diphtheria, which apparently is permanent.

(c) A pseudoreaction has the same significance as a negative reaction.

(d) A combined reaction has the same significance as a positive reaction.

(e) A doubtful reaction should be considered as a positive reaction, and therefore requires immunization.

The Schick test is positive between the ages of one and four years in about 32 per cent of normal children. It is positive in a slightly larger proportion of measles cases, in twice as many cases of scarlet fever, and in nearly three times as many cases of poliomyelitis. Susceptibility to one of the less contagious diseases, like poliomyelitis, indicates that the child is more likely to be susceptible to other contagious diseases. After the sixth year the proportion of positive reactions rapidly decreases, being positive in from 4 to 10 per cent only. In adults, 85 to 95 per cent of the tests are negative.

Toxin-antitoxin Mixture. This has been used in connection with developing immunization against diphtheria in persons who show a positive Schick test.

Bauer's¹⁵⁸ results are most interesting. It is common knowledge that a certain percentage of all individuals are immune to diphtheria, and that this immunity is due to an actual antitoxin content in the blood. The Schick test is performed by making an intradermal injection of $\frac{1}{50}$ of the minimum lethal dose of diphtheria toxin in 0.2 cc of normal salt solution into the superficial layers of the skin. These injections are carefully checked up by controls, and if, on the third day, an unfavorable reaction occurs at the site where the toxin of diphtheria was injected, then the patient is susceptible to diphtheria and is known as a positive Schick test. A negative result means quite the contrary. The Schick test has nothing to do in helping to tell who are, and who are not, "carriers." After the person has been classified as being capable of developing diphtheria if exposed to the infection, then the next step possible is to immunize him against the disease by the injection of 1 cc of the toxin-antitoxin mixture, given for three doses—injections at intervals of one week. Biological-products manufacturers put on the market, in suitable form, material for performing the tests and the toxin-antitoxin mixture for immunization.

Thus far it is believed that, as determined by Gorter and Huinink,¹⁵⁹ the toxin-antitoxin mixture confers immunity for at least two years. The advantages of this test to immunization are almost incomprehensible, and will go a long way to help stamp out this dreaded disease.

The applications of these tests have their greatest field at present in home orphanages, boys' and girls' schools, children's wards and hospitals where epidemics occur rather frequently among employees and nurses.

Bosler,¹⁶⁰ in a study of immunization against diphtheria by the toxin-

¹⁵⁸ Pennsylvania Medical Journal, April, 1921, p. 471.

¹⁵⁹ Archives de Méd. des Enfants, Paris, 1920, **23**, 338.

¹⁶⁰ Therapeutic Gazette, p. 883.

antitoxin mixture, states that the administration of toxin-antitoxin gives, in 90 to 97 per cent of cases, an immunity which lasts over four years, in all probability longer, and possibly for life. The immunizing action of toxin-antitoxin is slow, and protection does not result for from two to six months, and in some cases longer. Consequently, in cases exposed to diphtheria, antitoxin should be given (only to the children showing a positive Schick) to afford immediate protection, bearing in mind that its protecting action is of short duration. The indiscriminate use of antitoxin as a prophylactic measure in cases of adults exposed is wrong, and its use in the aged is to be condemned, the opinion of various health boards notwithstanding. The reactions to the antitoxin mixture are apt to be in adults. It is an open question whether adults should be immunized, even though they show a positive Schick, unless in cases of nurses and others who are apt to be frequently exposed. The mixture in full doses is well borne in children. Infants under six to nine months should not be immunized, unless it be with the distinct appreciation of the fact that immunity occurs in only 50 per cent of the cases, the immunizing action of the toxin-antitoxin being hindered by the presence of inherited antitoxin. Children between nine months and twelve years should be immunized irrespective of the Schick reaction at the time. Children between two and fifteen years should be Schick-tested, and only those giving a positive test should be immunized. The toxin-antitoxin mixture should be prepared in a reliable laboratory, and before being sent out should be carefully tested for potency and toxicity. The Dallas accident should have no repetition, and a valuable agent should not suffer on account of a non-potent product given out under its name.

INFLUENZA PNEUMONIA. The use of convalescent serum in the treatment of influenza pneumonia proved a safe therapeutic agent in the hands of Sanborn.¹⁶¹ He feels that clinical improvement consistently followed its administration even in those who finally succumb to the disease.

Convalescent serum had value when it was administered during the first three days of the pneumonia, in his series of cases. The value of the serum rapidly decreased when administered after the third day of the pneumonia, as indicated by rapidly increasing mortality rates according as administration was delayed from day to day. Given through the first three days, it was three times as efficient as when delayed to the fourth day, and seven times as efficient as it was when deferred until the fifth day. Given during the first four days of the pneumonia, it was five times as efficient as it was when given during the succeeding four days.

ACUTE POLIOMYELITIS.—Rosenow¹⁶² reports excellent results in the treatment of acute poliomyelitis with an immune horse serum prepared by repeated injection of the pleomorphic streptococcus from poliomyelitis. The serum was injected intravenously and intramuscularly because it yielded excellent results. Intraspinal injection of the serum

¹⁶¹ Boston Medical and Journal, August 5, 1920.

¹⁶² Journal of the American Medical Association, August 20, 1921.

was not considered advisable because this method renders monkeys more susceptible to the virus. The following is a summary of the results according to groups of all patients treated with the serum.

Condition of patient.	Patients.		Deaths.		Recovery with residual paralysis.		Complete recovery.		Recovery without developing paralysis.		Early good effects.		Late results unknown.		Effect doubtful or not apparent.		Average cell count.		Average duration of disease at the time of first serum treatment, days.		Average age, years.		Average amount of serum given each patient, cc.			
	Patients	Deaths	Patients	Deaths	Patients	Deaths	Patients	Deaths	Patients	Deaths	Patients	Deaths	Patients	Deaths	Patients	Deaths	Patients	Deaths	Patients	Deaths	Patients	Deaths	Patients	Deaths	Patients	Deaths
Group 1. Patients without paralysis at the time of serum treatment	60	0	0	60	59	59	0	1	114	1.7	5.3	18														
Group 2. Patients with slight paralysis at the time of serum treatment	61	0	1	60	0	58	0	3	120	2.1	5.4	22														
Group 3. Patients with advanced paralysis at the time of serum treatment	123	18	30	61	0	74	14	34	117	5.8	7.2	32														
Sporadic cases	15	1	6	8	..	12	0	3	148	3.4	5.3	49														
Total	259	19	37	189	59	203	14	41	119	3.8	6.2	27														

The immediate effect following the administration of the serum when given during the febrile stage was a lowering of the temperature and a reduction in the pulse-rate. The abolished or lessened reflexes improved. Sleep was produced in nervous and irritable children and the changed mental condition tended rapidly toward its normal state.

All symptoms and signs present showed evidence of improvement. From comparison made between the results obtained with immune horse serum with those obtained by treatment with serum from convalescent patients, he believes that immune horse serum gives the best results. As in most other serums, the good effects of the serum noted were in direct proportion to the earliness of the injection. The benefits obtained were independent of the withdrawal of spinal fluid. He believes, from the results obtained, that he is warranted in believing that the serum he developed has curative powers in this dreaded disease, especially when given early in the disease, the early diagnosis of which he emphasizes.

PUERPERAL INFECTION.—Murray,¹⁶³ in the discussion of puerperal infection with regard to the use of serum and vaccines, believes them to be very necessary as part of the battle against this disease. Early, while waiting for the results of the blood cultures, it is not only legitimate,

but highly advisable, to give antistreptococci serum. It should be given in large quantity (50 cc) intravenously, and diluted with not less than an equal amount of salt solution. If no improvement results in twelve to twenty-four hours the injection should be repeated, using, if possible, the brand of a different maker. From the blood cultures if positive, the preparation of an autogenous vaccine should be begun immediately, which appears to be of distinct service, and, according to one careful observer, reduces the mortality of definite septicemia from 85 to 95 per cent. The dose in each case must vary, and must be determined on its own merit. Murray doubts if a stock vaccine is ever advisable in acute cases, except preliminary to the preparation of a stock vaccine.

YELLOW FEVER.—Noguchi¹⁶⁴ states that the transmission of yellow fever from man to guinea-pigs and the isolation of *Leptospira icteroides* has been repeatedly accomplished by different workers in various epidemics. This discovery has made possible the development of a vaccine and serum, both of which have proved most effective when used under certain conditions.

Anti-icteroid serum reduces the mortality in yellow fever when used on, or before, the third day of the disease. He states that the average death-rate in untreated cases with serum is 56.4 per cent. In order that the serum should yield beneficial results, it must be given on, or before, the third day of the disease. Of 170 cases, 95 received serum on, or before, the third day, with 13 deaths (13.6 per cent mortality).

When serum is given after the fourth day, it has no appreciable value, as will be noted in the other 75 patients (the remainder of the series of 170 cases), in which 39 deaths occurred (a 52 per cent mortality).

Prophylactic inoculation, by means of the injection of 2 cc of the killed culture of *Leptospira icteroides* (containing at least 2,000,000,000 organisms per cc), is of definite protective value. Among 3230 persons vaccinated twice, no case of yellow fever developed, while 278 cases occurred among the non-vaccinated, notwithstanding that both groups were equally exposed to infection. Only 5 suspicious cases developed among 4307 persons receiving only a single inoculation. Protection from vaccination does not become effective until ten days after the last injection. There were 23 such cases among 7537 persons who were vaccinated with the standard vaccine. Vaccination, however, does not supplant the method of elimination of yellow fever, by the anti-stegomyia campaign.

Silver.—Lederer¹⁶⁵ reports his experience with local applications of silver nitrate in 25 cases of *pertussis*. The night attacks lessened, and in long-standing cases the attacks no longer recurred. The spastic stage was shortened. As the treatment is somewhat painful, it must be used with care in timid and nervous children. During the first two weeks the pharynx is painted every two days with a 2 per cent watery solution of silver nitrate. Then the treatment is interrupted for several days to note the effect. If the paroxysmal attacks do not

¹⁶⁴ Journal of the American Medical Association, July 16, 1921.

¹⁶⁵ Wiener klinische Wochenschrift, November 25, 1920, p. 1049.

decrease, the nitrate is discontinued for another week. The treatment did not prevent contagion of others in the family, and he ascribes its effect mainly to suggestion.

Gellhorn¹⁶⁶ states that he employed successfully in the treatment of *vulvovaginitis*, nitrate of silver in the form of a 1 per-cent ointment (silver nitrate 1, and white petrolatum and lanolin of each 50). This ointment is injected into the vagina through an ordinary glass syringe with a slender nozzle to which a piece of soft-rubber catheter or tubing, about 3 inches long, is attached. The tubing is changed for each patient. It can be introduced without pain into the vagina of even a very small child, and is slowly pushed inward the entire length of the vagina. The latter is then very slowly filled to capacity with the silver salve. The excess of salve which oozes back through the hymenial opening is not wiped off, as it is meant to cover and protect the irritated vulva and its surroundings.

The treatment is given once a day without any additional douching. Every seventh or eighth day, after a day of rest, a smear is examined, and the injections are continued if gonococci are present. If they are absent, smears are made at intervals of three days without any further treatment until at least three have been found negative. It is then advisable to send the child home, but insist on a final examination in two weeks. Occasionally, provocative silver nitrate injections are made and smears examined subsequently.

As a result of this treatment, the discharge and other excoriations, as a rule, disappear very quickly.

The 1 per-cent silver nitrate salve has been used in his service at the City Hospital (St. Louis) upon children ranging in age from nine months to twelve years.

Cattani¹⁶⁷ details a historical sketch of the subject of *removing tattooing*, from 4000 B.C. to the present date, and discusses the various methods that have been used for the eradication of the pigment. No one procedure is applicable to all kinds of cases, any one of thirteen methods can be applied. The choice of method had best be made between the Variot method, the galvanocautery under local anesthesia, harpooning (according to Wederhake) and excision of the pigmented area. He has applied the Variot method in a number of cases with complete removal of the tattooing, as a necrotic scab is thrown off. After the inflammation from rubbing in silver nitrate and powdered tannin, the procedure is painful and requires much patience and time. The harpooning is down through an incision, turning back the skin flaps and picking out the deposits of pigment from the underside of the skin. The skin flaps are turned back and fastened to a small board. This exposes all the deposits of pigment without modifying the skin except for the one incision.

Squill.—An editorial,¹⁶⁸ comments on the value of the observation made, by means of the electrocardiograph, on the effects of squill by White,

¹⁶⁶ Journal of the American Medical Association, December 11, 1920.

¹⁶⁷ Schweizerische Medizinische Wochenschrift, Basel, February 10, 1921.

¹⁶⁸ Therapeutic Gazette, February, 1921.

Galboni and Viko. For many years it has been recognized by the medical profession that squill was closely allied to digitalis in its influence on the heart muscle. It has been also recognized that in an overdose it was somewhat irritating to the kidneys, and at times would act more efficiently in cases of cardiac dropsy than digitalis.

The conclusions of these observers were that while squill emphasizes the effects of digitalis and acts in a manner closely allied to it, it is a much more feeble drug in its influence upon the heart muscle, and for this reason is of little value as a cardiac stimulant. It is also interesting to note that, as far as electrocardiographic records are concerned, they found that full doses depressed, flattened or inverted the T-wave as does digitalis, and that heart-block might be produced by larger doses. It was also interesting to note that squill only increased the urinary flow after the drug had so reduced the pulse-rate to be noticeable in its effect.

Squill, therefore, while producing a digitalis-like effect, is far less powerful than digitalis, and cannot be used as a substitute for this drug.

Sodium Citrate.—Steele¹⁶⁹ reports excellent results from the use of intravenous injection of sodium citrate solution in 6 cases of *thrombo-angeitis obliterans* (Buerger's disease). During the last three years he has used the following technic with encouraging results. During the first month the patient is kept in bed, with legs constantly under a hot-air electric light bath at 110° F.; 250 cc of 2 per cent sodium citrate solution is given intravenously every second day. The second month the interval of injection is lengthened to every third or fourth day; daily leg massage is given, and the patient is put in a wheel chair with his feet hanging down a short time each day; or, if the case is not advanced, some walking is allowed. The intervals are now gradually lengthened, until at the end of a year the patient gets one every two weeks. Increased walking is permitted as the symptoms subside and evidence of functional collateral circulation appear. Potassium iodide (10 grains three times daily) is given during the whole course of treatment. The iodide is always well borne. The length of treatment is regulated by the results obtained in establishing a functional collateral circulation.

The effects of this plan of treatment have been: (1) Relief of pain after the second injection; (2) the checking of the gangrene and spontaneous amputation of the dead tissue; (3) healing of indolent, painful ulcers; and (4) a slow but sure establishment of a collateral circulation, as shown by improved color, warmth of the foot, the swelling of the subcutaneous veins, and the strengthening of any existing pulse. In 2 cases there occurred a reestablishment of an anterior and a posterior tibial pulse.

The injections are given in the veins of the arm through a curved slip-joint needle, by the usual skin-puncture method. No bad after-effects were noted.

Six patients in all have been treated. Two have resumed their

¹⁶⁹ Journal of the American Medical Association, February 12, 1921.

regular occupations. One is walking around again functionally able, but has no financial urgency to set him to work. One, with a previous leg amputation, has resumed his occupation as a playwright. One case is progressing satisfactorily. In the sixth case, a desperate one, the patient walked after one year of treatment, but suffered relapse after four months of walking. He is now yielding to a second course of injections.

Sodium Lactate—Curatolo¹⁷⁰ gave this drug to two *diabetics* up to a daily dose of 50 to 60 gm. The alkaline lactate reduces the polyuria, neutralizes acid, and the output of sugar dropped in the urine from 7 to 3.3 or 4.8 per cent in the younger of the two diabetics. He states that Faelli has reported highly satisfactory results in the poisoning of grave diabetics, reaching the daily dose of 100 to 120 gm. daily.

Sodium Salicylate.—Neilson¹⁷¹ found that sodium salicylate used properly in the treatment of *influenza* can be given intravenously without harmful effects and produce a relief of pain and restlessness and saves the patient from the wear and tear of a severe toxemia. It also places him in a better position to fight more serious developments of the disease. Sodium salicylate should not be used if there is any evidence of pneumonia.

Strychnine.—Respino¹⁷² vividly describes his own experience when he took 10 cg. of strychnine in water by mistake for quinine, and assigns a very unique, yet plausible, explanation for his recovery, while a robust young woman taking one of the wafers at the same time soon died in convulsions. His first symptom was itching of an intense nature, then slight sensations of suffocation, fleeting phosphorescent visual sensations and slight nausea, but no pain or regurgitation. The tonic contractions of the larynx became more severe, rendering it difficult to swallow the coffee ordered for him after a hypodermic of caffeine and camphorated oil. Four or five tonic contractions followed, which were so violent that the pain caused unconsciousness. During the paroxysms, artificial respiration was applied as indicated—an enema of chloral was given, and although the nervous symptoms persisted throughout the day, and he was very much better at the end of two or three days, he ascribes his recovery due to the fact that the organs which strychnine predominantly affects, namely, the gray matter of the medulla and spinal cord, were already diseased, as his legs had been long paralyzed, and both hips were ankylosed from disease in youth.

Tannin.—This drug is used for its astringent properties and occurs in a large number of vegetable compounds. On account of its irritant properties, tannic acid is not often used by oral administration, but some substance is combined with tannic acid to lessen this action, at the same time with the hope that the juices of the intestinal tract will readily split up this compound and liberate the tannic acid for its effect in place. As a result there has been manufactured the combination of tannic acid with various proteins, such as "albutannin,"

¹⁷⁰ Polyclinico, Rome, December 20, 1920.

¹⁷¹ U. S. Naval Medical Bulletin, April, 1921.

¹⁷² Siglo Medico, Madrid, September 25, 1920.

"tannalbin" and "protan" and the organic esters of tannic acid, "acetannin," "tannigen," "tannopin" and "tannoform" and a heterogeneous group of other compounds "tannismuth" and gallogen.

With a view of determining the effects of these compounds when introduced into the gastro-intestinal tract, Leech¹⁷³ studied the effect of the various substances, with the following results: Only one type of the tannic acid compounds studied completely resists the action of the gastric juice and is broken down in the intestine according to theory, *i. e.*, the diacetyl tannic acid compound. "Acetannin Calco" is satisfactory (only one specimen of this product was available when the study was made). "Tannigen" is fairly satisfactory in some instances; in others it is not; certain is it that the market supply of "Tannigen" is not a reliable composition.

"Protan" and "Tannoform" are both readily soluble in sodium bicarbonate mediums. They are probably not broken up to a great extent in the intestine.

"Albutannin Calco" and "Albutannin M.C." are not nearly so resistant to the acid-pepsin digestion as "Tannalbin" and "Tannin Albuminate Exsiccated." Both "Tannalbin" and "Tannin Albuminate Exsiccated" (the latter now sold as "Albutannin Merck") are themselves not sufficiently resistant to the acid-pepsin medium, but they do liberate free tannic acid in the alkaline pancreatic medium.

With the exception of the specimen of acetannin, none of the products which were examined according to the methods described in Leech's paper conformed strictly to the claims made for them.

Tansy.—Oil of tansy has been used very frequently by certain classes of the laity for the purpose of inducing abortion. The effect of oils of tansy, juniper, rue, savin, pennyroyal, which have been used as emmenagogues in 1 per cent emulsion made in Ringer's solution were investigated by Gunn¹⁷⁴ as to their action. In small doses there was no action at all; in higher concentration, such as never could be used in the blood without producing probably fatal poisoning, they inhibit uterine movement. Abortion following their use is held to be the result of the violent action on the bowels and intestines.

Thyroid Extract.—Loeb¹⁷⁵ studied the effect that the administration of iodine and thyroid gland would have on compensatory hypertrophy of thyroid glands in guinea-pigs. Iodine did not inhibit while, on the contrary, the feeding of thyroid gland to guinea-pigs did inhibit compensatory hypertrophy of the thyroid gland. The effect is a direct and specific one and it is not an indirect effect called forth by the loss of weight, which is induced through thyroid feeding. Iodine preparations given simultaneously with thyroid tablets do not counteract the effect of thyroid. An editorial¹⁷⁶ states that at the present time, when the employment of various endocrine glands is being resorted to in rather a haphazard manner, and when certain clinicians are publishing enthusi-

¹⁷³ Journal American Medical Association, October 23, 1920.

¹⁷⁴ Journal of Pharmacology and Experimental Therapeutics, January, 1921.

¹⁷⁵ Journal of Medical Research, July-September, 1920.

¹⁷⁶ Therapeutic Gazette, December, 1920, p. 325.

astic reports while others are failing to obtain results of any value, it is well for the average practitioner to occupy a judicial position. While on the one hand he should hold himself open to all information which may occur, on the other hand he must not be guilty of administering organic substances which may do harm as well as good in view of the limited knowledge which he possesses as to the influence exercised by these glands upon the function of their fellows.

Just as diphtheria antitoxin has proved itself *facile princeps* as compared to all other antitoxic serums, so has the use of thyroid gland achieved its position in endocrine therapy. While it is perfectly true that in a lifetime of active practice, a medical man may not meet with a well-developed case of myxedema or cretinism, it is true that larval forms of these two conditions occur much more frequently than has heretofore been recognized, and that the physician who keeps his eyes open for such modified forms will often obtain excellent results from the use of thyroid gland.

Many of the glands of internal secretion are destroyed when they enter the stomach and so are prevented from exercising their ordinary physiological influence, but this is not the case with the thyroid. From the first, however, it has been recognized that whether the crude gland itself, or some dried product, or some extract of it, is used, the physician has an uncertain remedy, because its physiological activity cannot be standardized, so that the physician has been somewhat in the position of the medical man who was forced to use cinchona bark before quinine was introduced.

Tuberculin.—Cohen¹⁷⁷ states that to obtain the best results from tuberculin it is most important to get the proper dosage. This is ascertained by finding the smallest dose that will produce a distinct reaction therapeutically either by mouth or subcutaneously. This amount is obtained by injecting intracutaneously in the patient's forearm, at the same time, 0.0000001 mg. distally, 0.000001 mg. medially and 0.01 mg. proximally, the injections being made in a diagonal line. By this technic, the same lymph channels are avoided and there is less chance of having the lymphatics carry tuberculin from the larger injections to the smaller. The sites of the injection are examined after twenty-four to forty-eight hours have elapsed for the presence of a papule or of induration, either of which is regarded as evidence of a reaction. If no reaction occurs, 0.0001 and 0.01 mg. are later injected similarly in the other arm, the smallest dose being distal and the largest dose proximal. If still no reaction occurs, 0.1 mg. and 1 mg. are then injected, and, if necessary, at a still later time 10 mg.

The smallest dose that produces a distinct reaction he administers therapeutically either by mouth or subcutaneously. The initial dose so determined has never in his hands produced an unfavorable reaction, although in some cases it has been as large as 0.01 mg. If this dose produces a favorable reaction, such as increase of appetite, reduction of temperature, a general feeling of improvement, etc., it is repeated

¹⁷⁷ Archives of Pediatrics, November, 1920.

every three or five days until it loses its effect, whereupon it is gradually increased until it again produces a favorable reaction. If it seems to produce no effect at all, he still repeats it for several weeks and then increases it. Should any dose produce an unfavorable reaction, such as rise of temperature, anorexia, malaise, etc., it is reduced. At intervals, tests for hypersensitiveness are again made by injecting intracutaneously in the forearm the dose the patient is taking and doses one-tenth of and ten times this amount. If no reaction occurs from any of these, he injects intracutaneously 100 times, 1000 times and 10,000 times the amount the patient is taking. If the amount producing the intracutaneous reaction is greater than the amount being given therapeutically, the latter is increased rapidly until it corresponds with the former. He has increased from 0.001 to 0.1 mg. in four doses, and from 0.00001 to 0.001 mg. in the course of a few days, without producing any unfavorable reaction.

His unusual rate of general increase is about 50 per cent, according to the following scheme: 1, 1, 5, 2, 3, 5, 7, 10, 15, 20, 30, etc. Sometimes he doubles the dose, and occasionally, when it has been found to be much below the dose producing a minimal reaction when injected intracutaneously, he increases it tenfold.

This method of administering tuberculin he has employed mostly in children. The form of tuberculin given was tuberculin Ruckstand (T. R.), because, in an experience with various forms of tuberculins, sera and vaccines extending over a number of years, he has obtained best results with this form. He has not found that it makes much difference whether the tuberculin is administered by mouth or subcutaneously. Both favorable and unfavorable reactions have followed the former, and he has frequently substituted hypodermic administration for oral and *vise versa* during a course of treatment without ever producing any change in effect or reaction.

He seldom, or never, gives tuberculin to patients who are doing well without it. In the first place, it seems unwise to interfere in such cases, especially as the indications are that the patient is manufacturing the proper amount of antibodies and there is a possibility that an additional stimulus may disturb the balance. In the second place, he says he does not feel competent to judge the effect or the value of tuberculin in a patient who is already improving without it.

Vaccines.—Rewalt¹⁷⁸ reports his experience in the treatment of 130 cases of *pertussis*, extending over a period of seven years, by the vaccine treatment (*pertussis* vaccine). The ages of the patients ranged from seven weeks to ten years. His early results were not as good as in recent years, which he believes were due to doses used being too small. In this series of 130 cases, the vaccine treatment failed absolutely in 6 cases, 45 cases were benefited to a greater or lesser extent, and 79 cases showed marked improvement. These results convinced him that the vaccine treatment of *pertussis* is the most valuable treatment at the present time, regardless of its failures. Larger doses and shorter

¹⁷⁸ Pennsylvania Medical Journal, March, 1921, p. 404.

intervals should be employed than have been used. In infants, an initial dose of 250,000,000 to 500,000,000 was used, and increased to 1,000,000,000 or more as the symptoms demanded. From three to eight doses were given at intervals of forty-eight to seventy-two hours, more than eight doses were not considered necessary. Older children were given an initial dose of 500,000,000, and each succeeding dose was doubled if necessary. In other words, if, after the second dose of 1,000,000,000 or the third dose of 2,000,000,000, there seemed to be improvement, the succeeding doses were held at this figure. If no improvement was noted, the larger doses were given. In a majority of cases the symptoms were made lighter and the course of the disease was materially shortened. The best results are to be expected from freshly prepared vaccine.

Freeman,¹⁷⁹ in his experience with 16 children with whooping-cough, in which pertussis vaccine was used at various periods of the disease, obtained no results in 5. Of these 5 cases, 3 were in the early stage of the disease and 2 were very late. Of the 11 remaining cases, all were very materially benefited and in 4 of these a practical cure was obtained. He is convinced that in order to get the best results, fresh vaccines must be used. The dosage used in his cases was 500,000,000 for the first dose, 1,000,000,000 for the second dose and 2,000,000,000 for the third and fourth doses.

Veronal.—Hassen and Wein¹⁸⁰ report that a woman, aged thirty-three years, was admitted to the Cook County Hospital in a lethargic state, from which she could be aroused with difficulty. While awake she gave intelligent answers, talked coherently, but sluggish, falling asleep during the conversation. The color of the skin and the visable mucous membranes were not changed, no cyanosis, no signs of external injury, deformities or paralysis of the extremities. The right eye exhibited a slight ptosis and weakness of the external rectus muscle, and diplopia was present. Respirations were 24 per minute, pulse 84 and temperature 98° F. Tendons and muscle reflexes (conjunctival and pharyngeal) were normal. The abdominal reflexes could not be elicited; the plantar gave a normal response (no Babinski or Oppenheim). The lungs, heart and abdominal organs and blood were negative. Blood Wassermann negative; the spinal fluid was not examined, as the authors were unable to obtain it. The lethargy gradually subsided, having lasted thirteen days, and followed a dose of 90 grains of veronal taken from November 27 to December 9 (date of admission to the hospital). A tentative diagnosis had been made of lethargic encephalitis until the patient recovered sufficiently from the sleep to give a history of veronal poisoning.

X-ray.—The use of the *x*-ray as a means of treatment increases with the better knowledge of the methods of administration and with improved apparatus for giving the treatments. The great danger, however, is always for those who do not understand that the *x*-ray has its limitations, to expect too much from this form of treatment.

¹⁷⁹ Medical Record, November 6, 1920.

¹⁸⁰ Journal of the American Medical Association, September 4, 1920.

Sufficient time has elapsed to form an opinion as to the value of the treatment given for the various diseased conditions. Amersbach¹⁸¹ states that, so far, no case of cancer of the larynx or pharynx has been cured by *x-ray*. In the early stage of the disease, operative treatment is most favorable. Experience has shown that repeated *x-ray* treatment before the operation markedly injures the healthy tissues, causing greater danger from hemorrhage, both during and following the operation. Irradiation after the operation need not be considered so seriously. In case of large tumors, especially of the pharynx, irradiation before the operation is indicated in some cases. In inoperable cases irradiation is, of course, indicated.

Thederling,¹⁸² in discussing the roentgen irradiation of skin cancers, states that the *x-ray* realizes an easy cure of rodent ulcer, with good cosmetic effects. In dealing with skin cancer, the aim must be to destroy the growth, if possible, at one sitting by a single maximal dose. Partial or insufficient dosage is dangerous, as it may incite the cancer to renewed growth. Therefore, only hard rays passed through a 3-mm. to 4-mm. aluminum filter may be used. The dose must be at least 40X; 50 to 60X is better. Occasionally a superficial cancer may be cured with weaker (15 to 20X), using 0.5 to 1 mm. filter, but such doses will not suffice if the deeper tissues are involved. It is often best to irradiate the lymph glands first and afterward the cancer proper.

In the treatment of sciatica, Japiot¹⁸³ has been very much impressed with the excellent results he obtained from the *x-ray* treatment. The effects thus obtained were far in excess of his expectations, even in those from one to ten years' standing. The benefit seems to be limited to the abolition of pain, and other symptoms were unchanged. Benefit was also obtained by roentgen-ray therapy in a case of Dercum's disease, and in 3 cases of sacralization of the fifth lumbar vertebra, relieving the pain promptly. The rays are applied along the fourth and fifth lumbar and the first four sacral vertebra, slanting down to the nerve, filtered through from 1 to 3 mm. aluminum. The intervals were from ten to twenty days, and the dose of 3H seems to be sufficient for the purpose.

Fox¹⁸⁴ has stated very tersely his opinion of the value of the standardized roentgen-ray treatment in the treatment of skin disease. He believes the roentgen ray is probably the most useful therapeutic agent for the treatment of skin diseases. Its versatility is shown by the great variety of conditions in which it can be used, including inflammatory diseases, those depending on epilation, pruritus and hyperidrosis, lymphatic disease and cancer. It is only by means of accurate standardization that its full value can be realized and its dangers eliminated. Standardized treatment requires the use of a Coolidge tube and interrupterless transformer. The quantity of ray can then be measured by pastilles or by arithmetical computation. The routine use of pastilles

¹⁸¹ Deutsche medizinische Wochenschrift, Berlin, November 11, 1920.

¹⁸² Münchener medizinische Wochenschrift, September 24, 1920.

¹⁸³ Lyon Médical, February 25, 1921.

¹⁸⁴ New York Medical Journal, November 27, 1920.

is unsatisfactory, as considerable experience is required, and as they introduce the element of personal equation. By means of the simple method of computation devised by MacKee and Ramer, the treatment of skin diseases by the roentgen ray has been revolutionized, and a great contribution made to dermatological therapeutics. The most brilliant results in his experience have been attained in eczema and in ringworm of the scalp, where the roentgen ray is certainly the method of choice. It has also been of great value in acne, psoriasis, seborrheic eczema, lichen planus and epithelioma. In chronic sycosis, localized hyperidrosis, and some cases of localized pruritus, it is the only remedy (except radium) that effects a permanent cure. Leukemic conditions and mycosis fungoides cannot even be temporarily improved by anything except the roentgen ray (or radium).

It seems that the roentgen-ray therapy has been very successfully used in the treatment of uterine fibroids. Martindale¹⁸⁵ has reported that of the 118 patients with this condition under his care, intensive *x*-ray therapy was applied in 37 cases. Five of the cases were operated upon subsequent to the application of the *x*-ray, 46 per cent of the cases he believed were suitable and the *x*-ray treatment successful in the treatment of these tumors.

Steiger's¹⁸⁶ report is very much better than Martindale's, insofar as 97 per cent of the 122 cases of myomas so treated retrogressed. Among the 101 traced to date there was complete amenorrhea, and the tumor disappeared in 42 and grew much smaller in 38. Three cases, in which hyperthyroidism was associated, failed and therefore he believes the *x*-ray is contraindicated in uterine fibroids when hyperthyroidism is present. In his 100 cases of hemorrhagic metropathies at the menopause, there was but 1 who failed to yield to the *x*-ray treatment.

Eden and Provis are of the opinion that roentgen-ray therapy should be the method of choice in treatment in women over thirty-eight years for all uncomplicated cases of severe hemorrhages in which no neoplasm is present.

The presence of inflammatory disease of the tubes and ovaries is a contraindication. No case should be submitted to *x*-ray treatment until it has been determined by a gynecological examination that no malignant disease or inflammatory complications or degenerative changes in the fibroids are present.

Yeast.—Hirshberg¹⁸⁷ issues a word of warning regarding the manner in which yeast is often prepared, and the manner in which it is kept. He states that investigators, such as Osborne, Mendel, Levene, McCaskey, Hawk and others, in obtaining, as they did, most satisfactory results by the use of yeast in the treatment of diseased conditions and as a food, they used yeast prepared and kept under most favorable conditions. Yeast, like milk, ought to be certified as to its freedom from germs. It is a complete food, as easily polluted as milk. The yeast one eats should be made in tanks, presses and pipes that

¹⁸⁵ Archives of Radiology and Electro Therapy, September 20, 1920.

¹⁸⁶ Schweizerische medizinische Wochenschrift, Basel, August 12, 1920.

¹⁸⁷ Medical Record, October 30, 1920.

can be easily cleansed with live steam. After the yeast is made, it should be kept in the grocer's or baker's refrigerator fresh, firm, effective, active with its vigors and growth unimpaired. It is obvious that the dirty, ugly looking huge hunks of yeast sold in many shops do not measure up to the standard of cleanliness which is required to avoid contamination.

Zinc.—Sollman¹⁸⁸ states that considerable dissatisfaction has been expressed with the official vehicle benzoinated lard used in making zinc oxide ointment (U. S P.). At the same time it was feared by many that a change in the vehicle would result in a sacrifice in therapeutic efficiency. In answers to questionnaires on this subject, members of the American Dermatological Association expressed themselves variously, but the majority report is distinctly in favor of petrolatum as the most desirable vehicle, being equal to lard therapeutically, and superior in consistency, keeping qualities, and absence of irritation.

¹⁸⁸ Journal of the American Medical Association, November 30, 1920.

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